EXHIBIT F

Expert Report of Michael Woods, M.D.

This report sets forth my opinions related to the design, development, and adequacy of the warnings for the TVT and TVT-O, and how both products are reasonably safe for its intended use of treating stress urinary incontinence. All of my opinions are held to a reasonable degree of medical certainty based on my education, medical training, clinical experience, medical literature, position statements, guidelines, practice patterns, curricula, medical textbooks, and various other material contained on my reliance list. I have reviewed the plaintiffs' expert reports. I reserve the right to supplement my report and opinions based on the review of new or additional materials.

Background:

I am an Obstetrician and Gynecologist focusing on treating incontinence, prolapse, and other pelvic floor disorders in rural populations in Nebraska and Iowa. I have been board-certified in obstetrics and gynecology since 1991 and in Female Pelvic Medicine and Reconstructive Surgery in 2013, which was the first year the certification became available. I received by bachelor's degree in 1981 from Knox College in Galesburg, Illinois, and received my medical degree from Loyola University Stritch School of Medicine in 1985. I then completed a four year residency in obstetrics and gynecology at the University of Nebraska Medical Center, completing the residency in 1989. I then took a position in private practice in Council Bluffs, Iowa from 1989-1997. I then started my own private practice in Bellevue Nebraska from 1997-2013. I briefly worked part-time as a Principal Research Physician for ICON Clinical Services and then accepted a position as a Urogynecologist for Shenandoah Medical Center in Shenandoah, Iowa from 2013 to present. I am a member of the American Urogynecology Society, International Urogynecology Association, and the American Board of Obstetrics and Gynecology, to name a few. I also sat on a number of ACOG committees over the years. I am a member of these organizations and societies because I share the same goals and visions they set forth in seeking to improve the lives of women. I have presented both nationally and internationally on areas involving gynecology and pelvic floor disorders. My CV is attached as Exhibit "A".

I am charging $550/hour for meetings and document review, $650/hour for deposition testimony, and $4,000 per day for trial testimony. Within the past four years, I have testified as

an expert in the following case: *Barton vs. Gibbs*, *Mullins vs. Ethicon*, *Thurston v. Ethicon*, and *Morrison v. Ethicon.*

Training and Experience:

I have a strong interest in women's health, public policy, quality, professional liability, gynecologic surgery, and vaginal surgery; in particular, the treatment of pelvic organ prolapse, urinary incontinence, and pelvic floor disorders. The passion for the treatment of pelvic floor disorders started very early in my career. I began working with slings for urinary incontinence the last two years of my residency and throughout my career. My early experience with retropubic needle suspensions, anterior colporrhaphy, Kelly plication, abdominal and vaginal paravaginal defect repairs, kept me looking for other treatment modalities. The traditional suburethral slings, Burch colposuspension and the MMK procedures appeared to work better than these other procedures, but were still not ideal.

I transitioned to TVT in 1999 after monitoring the initial clinical literature, paying close attention to the mesh erosion/exposure rates. I was impressed with the high success rates and low complications that were consistently being published. I was able to replicate similar results using the TVT in my clinical practice. I previously had experience with suburethral slings as a salvage operation using Autologous slings, porcine skin, bovine dura mater, vicryl mesh (absorbable), Gore-Tex mesh, and Mersilene mesh. The reason I used a variety of synthetic, cadaveric and xenograft materials is because I was searching for something better than the Autologous fascia sling. Erosions and failures became evident early on in each of the procedures except for Autologous slings; however, obtaining the fascia in many of the patients was difficult and had complications of their own. In the 1990s, the open or laparoscopic Burch Colposuspension was my primary procedure for genuine stress urinary incontinence, and I was looking for a replacement for Autologous slings that did not require morbid harvesting of the patient's own tissues. I was searching for a mesh that incorporated into the tissues without becoming infected at the rates I saw with Amid Type III meshes. After talking with our general surgery team, I learned that they were having the best experience with Prolene hernia meshes. This was at the same time Amid published his mesh classification, which then prompted me to look at using Prolene mesh in the pelvis through a vaginal approach. Initially, I was concerned about the potential of seeing the same complications with Prolene that I had seen with

Mersilene, Dacron, and Gore-Tex meshes, but I quickly learned that Prolene was different and that we possibly had the right procedure with the right material.

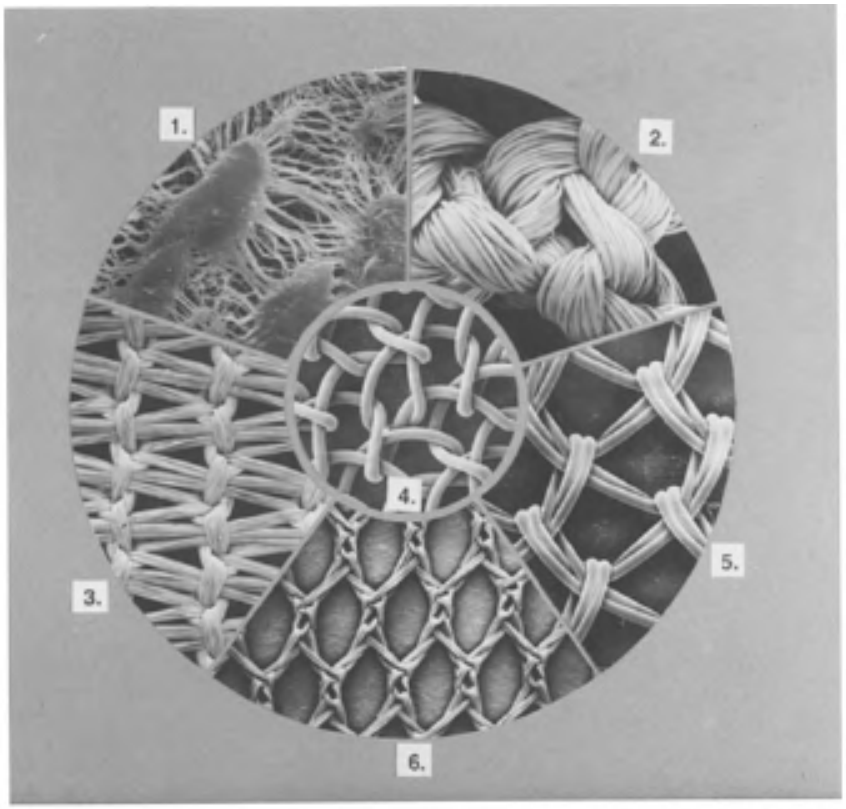


Fig. 1. Scanning electron micrographs of: *1*, Gore-Tex (X 1110); *2*, Teflon mesh (X 35); *3*, Surgipro (X 17); *4*, Marlex (X 17); *5*, Prolene (X 17); *6*, Mersilene (X 17)

[1]

Macroporous biomaterials with pore sizes large than 75 μm, such as monofilamented polypropylene mesh, do not promote or harbor infection. Furthermore, should the surgical field with a reported incidence of less than 0.3% [11–15] become infected, the monofilamented biomaterial would not have to be removed. In these situations, drainage of the wound is all that is needed for management of the infection. Microporous biomaterials with pores smaller than 10 μm, such as expanded PTFE (Gore-Tex), polyester mesh (Mersilene), multifilamented polypropylene mesh (Surgipro), and PTFE mesh (Teflon) can promote or harbor infection. In case of infection, the microporous biomaterials often need to be removed [16, 17].

[1] Amid (1994): Biomaterials for abdominal wall hernia surgery and principles of their applications.

Initially, I learned the TVT as my salvage procedure for my patients who experienced a failure with a Burch or retropubic suspension procedure. I was impressed with the quick learning curve of TVT, reproducibility from different centers, standardization of the tension-free technique, and I was comfortable with the use of trocars in the pelvis. I did not feel that the trocar passage was any different going from bottom up than using a Stamey needle or long needle driver with an Autologous sling going from top down. While the concept of tension-free placement was nothing new with TVT, it was previously not standardized with the Autologous slings, and learning to get it just right was difficult to perform, and more so to teach.

The utility of TVT outweighs the utility of Autologous fascial slings and the Burch colposuspension because the TVT is a shorter procedure, less invasive, requires a shorter hospital stay, quicker recovery time to normal activities, avoidance of prolonged catheterizations, reduced risks for urinary tract infections, and fewer severe retention and voiding complications. These benefits of TVT compared to traditional procedures are significant, even when considering the unique, but not serious, risk of mesh exposure. The rate of mesh exposures for Amid Type I TVT ranges an average from 1-3% in the peer reviewed literature; most of which occur in the first six months and are easily managed with conservative treatment or a simple excision. My mesh exposure rate is approximately 1%, and my reoperation rate is approximately 3%, primarily for urinary retention or voiding dysfunction.

With both the Burch and Autologous sling procedures, I expected patients to be in retention and have voiding dysfunction after the surgery, as they would go home with a catheter in place anywhere from 4 days to one month, sometimes leading to persistent retention or voiding dysfunction. By contrast, patients who received TVT were expected to void normally within 24 hours, as opposed to up to 6 weeks with traditional procedures. One of the benefits of TVT compared to traditional procedures is that if I had a patient who was unable to void within 24 hours of having a TVT, I could easily adjust the tension of the TVT in the office where I would use local anesthetic and then cut the midline suburethral suture, and then tunnel up along the trajectory of the sling and then grasp the sling 2-3cm away from the midline, pull down to loosen the sling under the urethra, and then I would then fill the bladder have the patient void. If a patient had delayed voiding dysfunction, then I would wait until 6 weeks and bring the patient back to the office. Once in the office, I would apply local anesthetic, open the incision, use a skin hook to easily locate the TVT, use local anesthetic to develop tissue planes, and then I would dissect between the urethra and the mesh to loosen the sling. Fortunately, retention and

voiding dysfunction after TVT has been uncommon and easily treated, unlike my experience with Burch and Autologous Fascial Slings.

I started using TVT in 1999, and since then I have performed thousands of procedures using TVT mesh, including both mechanically cut and laser cut mesh. I have performed thousands of TVT procedures and have used all of Ethicon's TVT family of products. I have not noticed any differences in the mechanical properties or design of the mechanically cut TVT compared to the laser cut TVT when they are used as intended in a clinical setting. I have also not noticed an increase in complications from patients who have had mechanically cut or laser cut TVT. I started performing Autologous fascial slings in the 1990s and have performed approximately 150 Autologous fascial slings. I have also performed over 500 Burch colposuspensions, including both open and laparoscopic procedures. I also have experience with pain management and treating pain with trigger points and nerve blocks.

The synthetic midurethral sling has replaced the former gold standard Burch colposuspension as the gold standard repair. The Autologous fascial sling was never considered the gold standard or first-line treatment option for uncomplicated stress urinary incontinence. There may be times when it is appropriate to perform a Burch or Autologous fascial sling based on a surgeon's preference and various patient characteristics, but I rarely perform either nowadays. It would be a disservice to women to go back to how surgical treatments for stress urinary incontinence were 20 years ago. Prior to TVT becoming available, I would counsel my Burch patients by telling them that they are likely going to be out of work for about six weeks. Additionally, I would tell my Burch patients that I would likely see them down the road to treat them for a recurrence of stress urinary incontinence, because the 7 year efficacy rate with Burch is around 70%-80%.

Stress Urinary Incontinence:

Stress urinary incontinence can have a significant effect on women as SUI can be a debilitating, embarrassing, and life-altering disease that can significantly impair a woman's quality of life. Urinary incontinence is a very common and debilitating problem affecting about 50% of women at some point in their lives.[2] Stress urinary incontinence is the commonest form

[2] Ford, Ogah (2015) Cochrane Review: Mid-urethral sling operations for stress urinary incontinence in women (Review).

of incontinence in women and leads to a reduction in their quality of life. Women with SUI can also have problems with sexual intercourse, as leakage of urine can occur. The National Institutes of Health State-of-the-Science Conference Statement on Prevention of Fecal and Urinary Incontinence in Adults (2007) reported that the current national estimates are that more than 20 million women have urinary incontinence or have experienced it at some point in their lives.

Individuals who are incontinent may have an emotional burden of shame and embarrassment as well as the physical discomfort and disruption of their lives that occur with episodes of incontinence. For example, some women may experience stresses in relationships, low productivity at work, job difficulties, arranging daily activities by bathroom location, and avoiding activities that provoke incontinence. Individuals who are incontinent may experience anxiety about leaking accidents, depression, social isolation, and social exclusion. The management of incontinence itself is burdensome. The total cost of urinary incontinence for individuals in the community in the United States has been estimated as exceeding $14 billion in the year 2000, with direct costs similar to other highly prevalent conditions, such as arthritis, and is somewhat greater than the cost of care for pneumonia, influenza, or even breast cancer. The major out-of-pocket costs are for absorbent pads, diapers, or briefs. Entry to a nursing home may not be related solely to incontinence, but may be triggered by it.

Transvaginal needle suspension procedures were first described by Pereyra in 1959, but subsequently the needle urethropexy underwent more than 20 modifications in an attempt to improve the cure rates and minimize complications.[3] Modifications involved various amounts of dissection and different anchoring tissue and materials. These procedures are currently rarely performed today because several comprehensive reviews and prospective RCTs have shown them to be significantly less effective than retropubic Burch colposuspension and sling procedures. The first suburethral sling procedure was described in 1907, and many variations of muscular and fascial slings have since been described to treat stress incontinence. The most popular and long-lasting sling variation was reported by Aldridge in 1942. He used two strips of rectus fascia sutured in the midline below the urethra via a separate vaginal incision. The fascial strips were brought down through the rectus muscle, behind the symphysis pubis, and united as

[3] Walters, Karram: Urogynecology and Reconstructive Pelvic Surgery.

a sling beneath the urethra. To overcome the limitations of using Autologous materials for slings, such as poor quality of fascial tissue, inadequate length, and need for harvesting procedures and their morbidity, synthetic materials began to be used for the sling graft. In spite of numerous refinements of technique and improvements in synthetic grafts, clear superiority of synthetic over Autologous materials for pubovaginal slings has not been demonstrated. In fact, some trials reported an unacceptably high rate of erosion and infection with older Amid Type III synthetic materials.

The tension-free vaginal tape (TVT) procedure was developed in the 1990s by Petros and Ulmsten which focused on restoring the pubourethral ligament support in the midurethra. The "integral theory" for the management of stress incontinence was based on the model that continence is maintained at the midurethra and not at the bladder neck. The aim of the tape (sling) is to reinforce the functional pubourethral ligaments and hence secure proper fixation of the midurethra to the pubic bone, allowing simultaneous reinforcement of the suburethral vaginal hammock and its connection to the pubococcygeus muscles. The synthetic sling material is made of Prolene polypropylene, which contains an antioxidant package to prevent oxidation, and is approximately 1 cm wide and 40 cm long. After the TVT became well-established, studied, and accepted, other approaches polypropylene midurethral slings became available to surgeons. Midurethral tension-free slings are minimally invasive procedures that have been shown to have high success rates and low complication rates.[4] Reported complications of retropubic slings, such as TVT, include those that are associated with passing a needle through the retropubic space, such as injury to bladder, urethra, bowel, nerves, and vascular structures. In an attempt to reduce these complications, Delorme introduced the transobturator approach, whereby the sling is passed using a lateral thigh approach through the obturator foramen. This technique was further modified with an inside-out approach as described by de Leval. These techniques have been shown to have equivalent cure rates and seem to reduce certain risks associated with the retropubic passage.

Numerous cohort studies and a large clinical volume worldwide seem to show that the TVT procedure is equivalent to other operations for cure of continence, with a quicker return to normal voiding and fewer postoperative complications. An important innovation of the TVT was

[4] Daneshgari F, Kong W, Swartz M. Complications of mid urethral slings: important outcomes for future clinical trials. JUral 2008;180:1890-1897.

that it could be done under local anesthesia as an outpatient, and often patients could void the day of surgery and be discharged home without a catheter.

The MMK procedure was first published in 1949 and was initially performed on incontinent males following prostatectomy with good results. The rationale for applying retropubic procedure to females with urinary incontinence was created to Bailey, Green, and Hodgkinson. The Mayo modification of this procedure was created by Dr. Lee and Symmonds. The Burch colposuspension was another modification of the MMK. I had the opportunity to observe and interact with Dr. Lee over the years through CAOG (Central Association of Obstetrics and Gynecology) and from referrals from many surgeons he had mentored and taught over the years. The most common complications included nerve injuries involving the peroneal, femoral, and sciatic nerves due to positioning of the patient, or retractors. Dissection and placement of sutures are more likely to injure the obturator or entrap the ilioinguinal nerves. Additionally, hemorrhaging and or hematoma formation during retropubic dissection due to disruption of the vessels in the venous plexus is known to happen, and is often difficult to avoid.

In a survey of 2,712 MMK cases, man Price found 9 cases of lower urinary tract fistula. Burch himself reported a vesico-vaginal fistula in one case. Incidental cystotomy was noted and about 1% of cases. Voiding dysfunction was a significant problem reported between 1.7 and 25% of cases, and this was known to persist even 3 months after surgery. Bladder over-activity was noted in 5-27% of patients who had a colposuspension. Another complication was the incidence of enterocele between 2 and 27%. In fact, prophylactic obliteration of the cul-de-sac was suggested by some surgeon's at the time. Osteitis pubis was reported up to 5% of patients who underwent the MMK procedure. A survey from the Mayo Clinic showed an incidence of 0.7 to 4%, which can be an extremely difficult infection to manage. Interestingly, 71% had positive bone cultures. It is also well known that abdominal procedures have a higher risk of development of thromboembolic events.

Over the years, surgery to stop this emotionally devastating problem has become less invasive, and there are many different types of operations available. The midurethral sling (MUS) operations are commonly undertaken to try and cure stress urinary incontinence. These operations are suitable for women who are having their first operation to prevent incontinence, and also women who have had unsuccessful surgery previously. In a midurethral sling operation a tape is placed underneath the urethra, which is the tube that carries urine out of the

bladder. When the woman coughs, the sling recreates the damaged pubourethral ligaments thus providing the support necessary to prevent urine leakage.

I was previously against using mesh for incontinence and prolapse treatments in the 1980s and early 1990s because of the infections I saw in patients who had Gore-Tex and Mersilene meshes. Fortunately, I was able to dismiss those concerns after seeing the benefits of TVT and TVT-O and their large pore mesh compared to the previous small pore Amid Type III meshes that surgeons were using to treat SUI. The infection rate with TVT mesh is incredible low, which is consistent with my clinical practice and the peer-reviewed clinical literature. After implanting several thousand TVT meshes from the TVT family of products, I have not seen a mesh infection.

Traditionally a suburethral sling has been recommended for urodynamic SUI caused by intrinsic sphincter disorder (ISD or type III incontinence), defined as failure of the urethral sphincter to maintain a watertight seal regardless of bladder neck position. Patients with ISD usually present with severe stress incontinence, decreased urethral pliability, low resting urethral closure pressure, and low Valsalva leak point pressures. Endoscopic or radiographic studies reveal an open bladder neck at rest. Recently, slings, especially tension-free midurethral slings, have been expanded for use with all types of SUI, regardless of urethral or leak point pressures. One of the main differences between the Autologous fascial sling and the TVT is that the Autologous sling is placed under the bladder neck, whereas the TVT is placed under the midurethra.

I attended an ACOG Postgraduate Course in 1988[5] and remember reading the following from the materials I received about traditional pubovaginal slings, such as the Autologous fascial sling: “Pubovaginal slings are old operations which are more difficult to perform than standard procedures, and because of their obstructive character, the potential for serious post-operative problems with urethral and bladder function is much higher. These procedures should be reserved for those patients with a proven abnormality of function of the proximal urethra or a rigid non-functional scarred urethra.” Additionally, the ACOG Postgraduate Course for Advanced Gynecologic Surgery for Prolapse and Incontinence at the 42nd Annual Clinical

[5] ACOG Postgraduate Course 120: 36th Annual Clinical Meeting, Urogynecology. April 30 and May 1, 1988. Citing McGuire, E.J., Retropubic Operative Procedures. In: Female Urology, 1983.

Meeting discussed using bolsters with for pubovaginal sling sutures to prevent “cheese-wiring” of tissue.

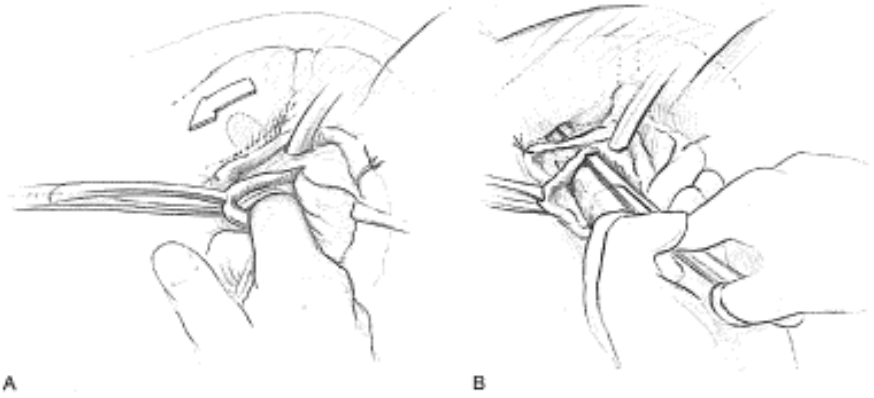


Figure 16-2 ▫ A. Technique of blunt dissection into retropubic space. With tip of index finger flexed anteriorly against posterior symphysis, periurethral attachment to pubic bone is perforated, completely detaching endopelvic fascia. B. Technique of vaginal entrance using Metzenbaum scissors; endopelvic fascia is perforated at inferior margin of pubic bone, as guided by surgeon's index finger. Blades of scissors are separated, and dissection is completed by inserting a finger into space created, as shown in *A*.

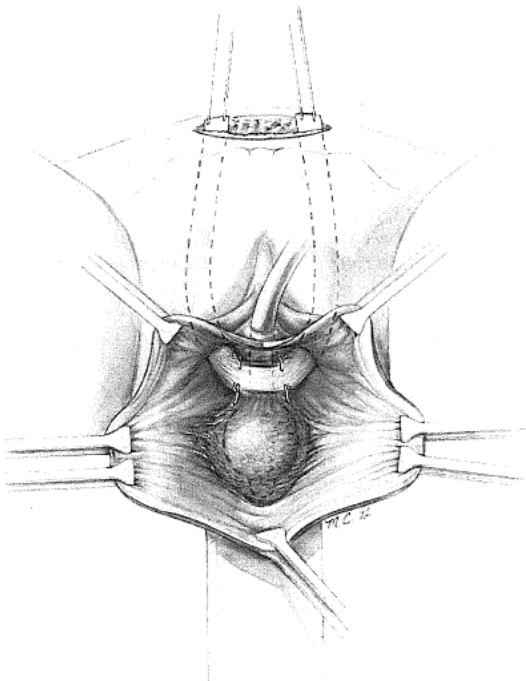


Figure 16-3 ▫ Full-length suburethral sling, in which fascia or synthetic material is passed and tied above the anterior rectus fascia.

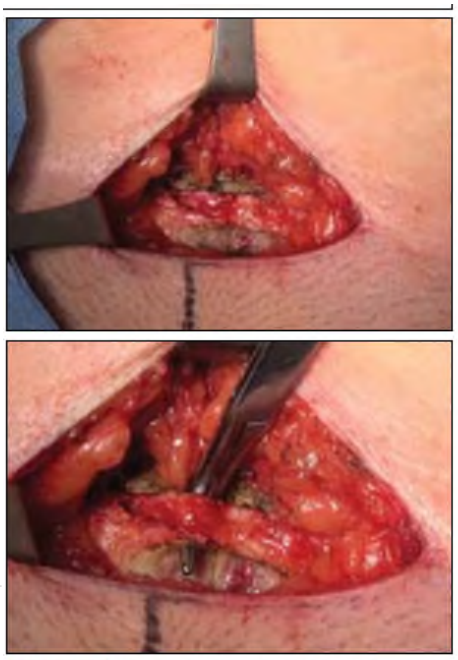


FIGURE 2 Resect the fascial strip

After choosing the optimal location for excision, mark the area using electrocautery or a surgical marking pen. Then resect the strip using a scalpel or electrocautery. The strip should measure 8 to 10 cm in length and 1 to 2 cm in width. If the skin incision is small, Army/Navy retractors may enhance exposure.

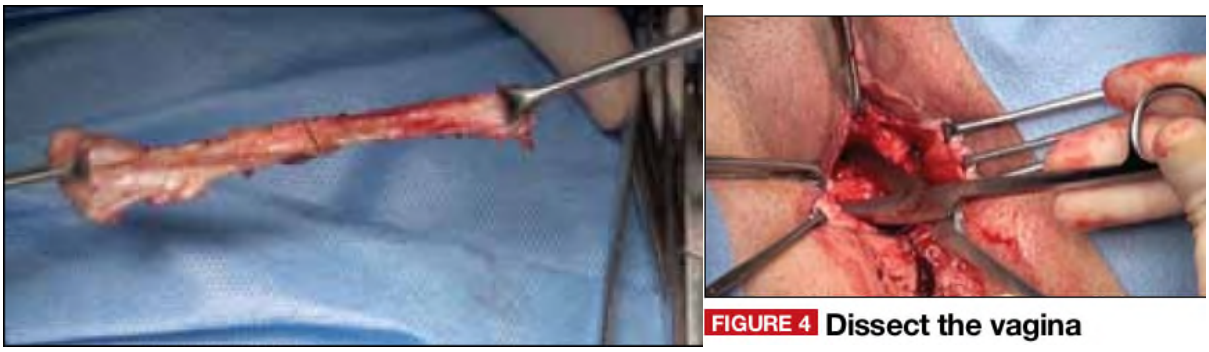


FIGURE 4 Dissect the vagina

Surgeons are familiar with how to properly tension midurethral slings based on their training and experience with traditional slings. Medical textbooks describe the tensioning process for both Autologous slings and midurethral slings, such as TVT and TVT-O. The procedural step for tensioning a traditional sling includes[6]:

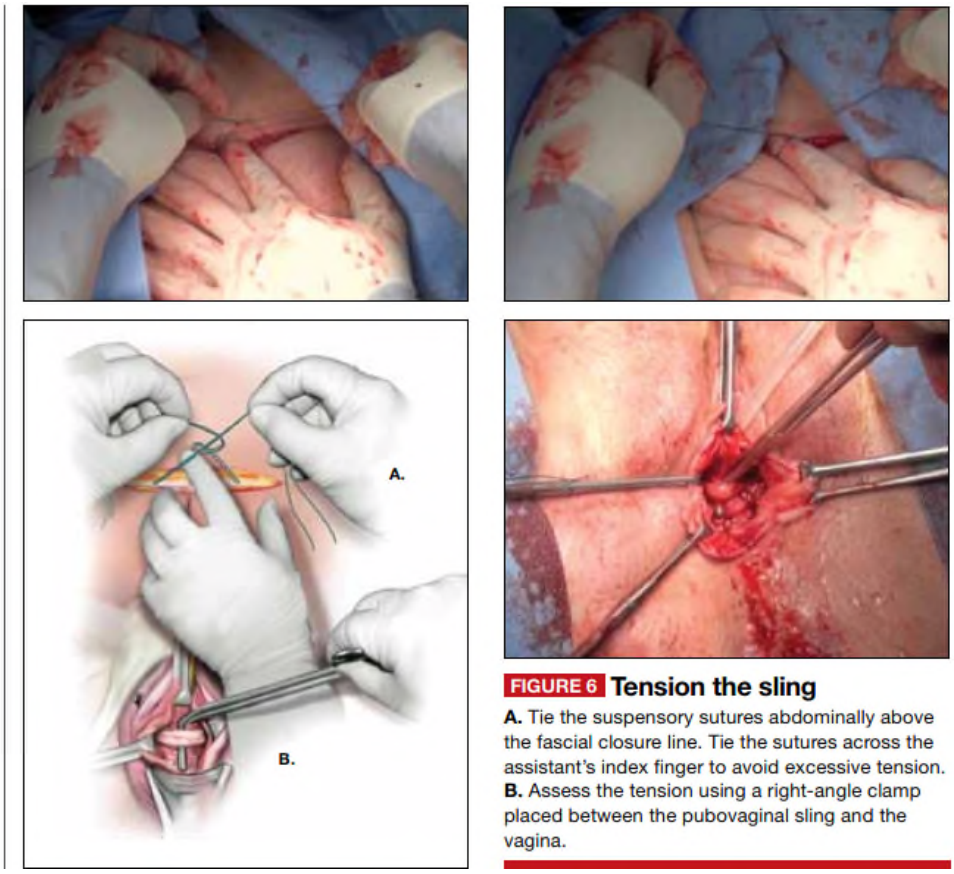


FIGURE 6 Tension the sling

A. Tie the suspensory sutures abdominally above the fascial closure line. Tie the sutures across the assistant's index finger to avoid excessive tension.
B. Assess the tension using a right-angle clamp placed between the pubovaginal sling and the vagina.

[6] Walters, Karram: Urogynecology and Reconstructive Pelvic Surgery.

Tensioning the Autologous Fascial Sling:

> "The final step involves appropriate tensioning of the sling. Unfortunately, no standardized method exists that can be used on all patients. One must individualize the patient based on the severity of her incontinence and the state of her pelvic tissue. In general, the sling should be placed loosely at the level of the proximal urethra and should act as a backboard to prevent descent of the proximal urethra during increases in intra-abdominal pressure."

Tensioning the TVT:

> And the procedural step for TVT includes the following: "The next step is to properly tension the sling to stabilize, but not obstruct, the urethra. The trocars are cut from the sheath and Kelly clamps are placed at the sling ends. The sling is pulled to the urethra with the overlapping area at the midline. Mayo scissors or a right -angle clamp is initially placed between the posterior urethra and the mesh. If the patient is under local or regional anesthesia, she may be asked to cough or perform a Valsalva maneuver. With the bladder full of 250 to 300 mL of fluid, the sling should be tightened to ensure that only a few drops of urinary leakage are present with coughing. If the patient is under general anesthesia, adequate looseness should be present between the urethra and the mesh. If desired, Credé's maneuver can be performed to simulate the Valsalva maneuver."

Some of the benefits of TVT are that complications are low, the operating time of TVT is relatively short, and the majority of patients can undergo TVT without general anesthesia as an outpatient or overnight stay.[7] Complications appear to be less severe and, possibly, less common than with pubovaginal fascial slings. In the multicenter study by Ward and Hilton (2002), intraoperative bladder perforation was recognized in 9% of procedures, but no long-term sequelae resulted. Nilsson et al. (2001) reported that 56% of patients with mixed incontinence had resolution of their urge symptoms after TVT, and 6% developed new symptoms of urge incontinence, findings that are similar to other sling procedures. Short-term voiding disorder is described in 4.3% of women, and retention requiring transection of the tape occurs in 1% to 2.8%. Mesh erosion into the vagina or urinary tract, as well as pelvic hematoma and bowel

[7] Walters, Karram: Urogynecology and Reconstructive Pelvic Surgery.

perforation, can occur but are very rare. Complication rates after a nationwide analysis of TVT in 1,455 women in 38 hospitals Finland in 1999 are shown below.

Table 16-1 ▪ TVT Complications in 1455 Patients in 38 Hospitals in Finland in 1999

Bladder perforation	3.8%
Minor voiding difficulties	7.6%
Retention	2.5%
Retropubic hematoma	1.9%
Major vessel injury	0.07%
Need for postoperative laparotomy for a complication	0.3%

From Kuuva N, Nilsson CG. A nationwide analysis of complications associated with the tension-free vaginal tape (TVT) procedure. *Acta Obstet Gynecol Scand* 2002;81:72, with permission.

Results. Among the 38 hospitals there were four university, 13 central and 21 local hospitals. The total number of operations was 1455. The incidence of bladder perforation was 38/1000, that of intra-operative blood loss over 200 ml 19/1000, of major vessel injury 0.7/1000, of nerve injury 0.7/1000, of vaginal hematoma 0.7/1000 and of urethral lesion 0.7/1000. The incidence of minor voiding difficulty was 76/1000, that of urinary tract infection 41/1000, of complete postoperative urinary retention 23/1000, of retropubic hematoma 19/1000, of wound infection 8/1000 and of vaginal defect healing 7/1000. No case of tape rejection or life threatening complication occurred and the incidence of complications requiring laparotomy was 3.4/1000. The ratio of number of complications to TVT operations performed did not vary significantly between different hospital types ($p>0.05$).
Conclusion. The TVT procedure is a safe method for the treatment of stress urinary incontinence provided that appropriate training is offered.

Table I. The number of complications associated with 1455 TVT operations performed in Finland by the end of 1999

	n	%	95% CI*
Per-operative complicatitions			
Blood loss over 200 ml	27	1.9	1.2–2.7
Bladder perforation	56	3.8	2.9–5.0
Injury of the epigastric vessel	1	0.1	0.0–0.4
Injury of the obturator nerve	1	0.1	0.0–0.4
Vaginal hematoma	1	0.1	0.0–0.4
Urethral lesion	1	0.1	0.0–0.4
Postoperative complications			
Complete postoperative urinary retention	34	2.3	1.6–3.3
Voiding difficulty	111	7.6	6.3–9.2
Retropubic hematoma	27	1.9	1.2–2.7
Hematoma outside the retropubic area	7	0.5	0.2–1.0
Wound infection of the abdominal incision	12	0.8	0.4–1.4
Defect healing of the vaginal incision	10	0.7	0.3–1.3
Urinary tract infection	59	4.1	3.1–5.2
Urge symptoms	11	0.8	0.4–1.4
Dysuria	2	0.1	0.0–0.5
Vesicovaginal fistula	1	0.1	0.0–0.4
Urinary retention related to urological anomaly	1	0.1	0.0–0.4
Pain in the region of the gluteal muscle and thigh	3	0.2	0.0–0.6
Venous thrombosis	1	0.1	0.0–0.4
Seroma formation	1	0.1	0.0–0.4
Total	367		

*Poison distribution.

Long-term complications after pubovaginal slings and TVT are mostly related to voiding dysfunction and urgency. The TVT procedure seems to result in a more rapid return to voiding; although, as with other slings, a small number of cases still result in retention requiring sling transection.[8]

Professional Education:

I have had the pleasure of attending and teaching other residents, fellows, and surgeons throughout my career. I have also had the privilege of serving as a preceptor for some of Ethicon's professional education courses. I attended Ethicon's Professional Education preceptorship for TVT in 1999 and was very satisfied with the discussion of the risks and benefits of TVT. I have experience teaching other surgeons about the adverse reactions in the IFU and have found that the IFU adequately warns of the risks associated with TVT. This is consistent with my discussions with other preceptors and surgeons as well as the medical

[8] Walters, Karram: Urogynecology and Reconstructive Pelvic Surgery.

literature. In 2001, I began teaching other surgeons about the risks and benefits of TVT, and how to safely and properly perform TVT procedures. I have also attended many of Ethicon's annual pelvic floor and incontinence summits. Additionally, I have consulted with Ethicon's medical affairs directors and engineers to provide surgeon feedback during the product development phase for several incontinence devices, and I have also had the pleasure of meeting Professors Petros, Ulmsten, and Nilsson.

I have used and trained other surgeons on both mechanically cut TVT and laser cut and can say to a reasonable degree of medical certainty that there is no clinical difference between the two when used as intended in a clinical setting and within the physiological range. I am familiar with the laser cut versus mechanically cut issue and have come to appreciate it as a marketing issue geared towards addressing surgeon preferences and an effort to improve manufacturing efficiencies. Some surgeons prefer what they trained on and had excellent clinical results using, so they saw no need to change from mechanically cut to laser cut, while other surgeons prefer the way the laser cut mesh felt. I am not aware of any medical literature showing a clinical or statistically significant difference in complications or success rates between mechanically cut and laser cut TVT, nor would I expect any difference because I have not seen any difference in safety or efficacy in the thousands of patients I have treated with both mechanically cut and laser cut TVT mesh. I am familiar with the physiological range and the data on in vivo forces under the midurethra. I am also familiar with the extreme benchtop testing that went into testing the stretch characteristics of mechanically cut and laser cut TVT at forces that are well beyond the physiological range or the intended clinical use. If the TVT mesh deformed and failed in women at forces well beyond the physiological range then we would expect women to become wet over time, which is inconsistent with the high long-term objective success rates with TVT.

TVT Retropubic revolutionized healthcare for women and has played a major role in improving my patients' objective cure and subjective/patient satisfaction rates. Professors Petros's and Ulmsten's integral theory made TVT revolutionary, along with the ability to perform the procedure under local anesthesia and having a standardized procedure that has reproducible data across the world. It wasn't until Ulmsten's published multicenter study when I accepted that TVT worked in the hands of regular surgeons as opposed to just Professor Ulmsten's hands. I have recommended TVT to my immediate family members who decided to undergo the procedure because TVT is the most and best studied product and procedure out

there for the treatment of stress urinary incontinence. Every patient I see is someone's mom, wife, or best friend, so I wouldn't recommend anything to anyone that I wouldn't recommend to my own family.

Development of TVT:

TVT is a modification of the traditional suburethral sling procedures. It is a modification of intravaginal slingplasty and was first described by Ulmsten and colleagues in the early 1990s. The aim is to restore the patient's urethra to its normal position by placing a sling of mesh tape called TVT beneath the midurethra. After surgery, the TVT supports the urethra during a sudden movement, such as a cough or sneeze, allowing it to remain closed which prevents the involuntary leakage of urine. The TVT reinforces or recreates defective ligamentous and supportive structures to support the middle urethra.

The initial data showed great results which were confirmed by RCTs, and then a flood of studies showing similar excellent results which resulted in TVT becoming the new gold standard, first line surgical treatment for SUI.

As of 2002, there were approximately 200,000 TVT procedures performed.[9] As of 2006, there were over 700,000 TVT procedures performed worldwide.[10] In 2001, authors published on the "United States Experience with Tension-Free Vaginal Tape Procedure for Urinary Stress Incontinence: Assessment of Safety and Tolerability,"[11] and concluded that "the TVT procedure for stress urinary incontinence is a safe, minimally invasive operation with minimal perioperative morbidity." No infection of the graft material or erosions of the graft into the urinary tract were noted on physical examination at the follow-up visit. The results of this study suggest that using a nonabsorbable mesh in the TVT procedure is safe, and the long-term advantage may be substantial. It is well known that the connective tissue in women with stress incontinence is defective. Both retropubic urethropexy and vaginal needle suspensions rely on this diseased tissue for their long-term result. In TVT, placement of the mesh results in a permanent,

[9] Debodinance (2002): Tension-free vaginal tape (TVT) in the treatment of urinary stress incontinence: 3 years experience involving 256 operations.
[10] Lord (2006): A randomized controlled equivalence trial of short-term complications and efficacy of tension-free vaginal tape and suprapubic urethral support sling for treating stress incontinence.
[11] Niemczyk (2001): United States Experience with Tension-Free Vaginal Tape Procedure for Urinary Stress Incontinence: Assessment of Safety and Tolerability

supportive neoalignment. The repair relies on the mesh, not the patient's defective connective tissue, for its result.

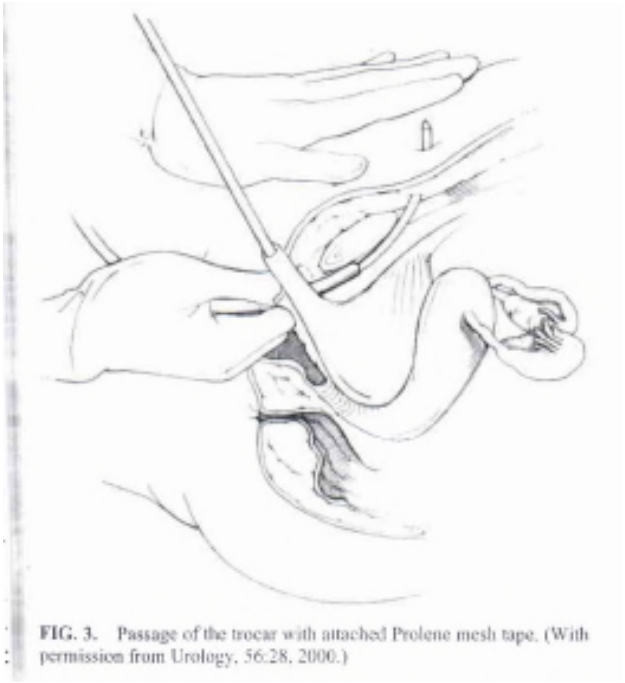


FIG. 3. Passage of the trocar with attached Prolene mesh tape. (With permission from Urology, 56:28, 2000.)

The advantages of the TVT procedure follow naturally from its technical simplicity. Any surgeon familiar with conventional anti-incontinence procedures can master this procedure. It is simple and quickly accomplished, requires minimal dissection, and can be performed easily with the patient under local anesthetic using intravenous sedation. Reported cure rates are equal to or better than more invasive retropubic urethropexy, and the TVT operation may prove to be the procedure of choice for many women with stress urinary incontinence The TVT operation is very similar to conventional suburethral sling placement. It is important to point out a key technical distinction between the operations. Unlike the conventional operation, adjustment of the sling's tension is precise in the TVT procedure. Only enough tension is applied to the sling to correct stress incontinence. It is possible that "overcorrection" and outlet obstruction are responsible for the voiding dysfunction that sometimes accompanies successful anti-incontinence surgery. This would explain why placement of the sling without excessive tension is so important in avoiding voiding dysfunction after surgery.

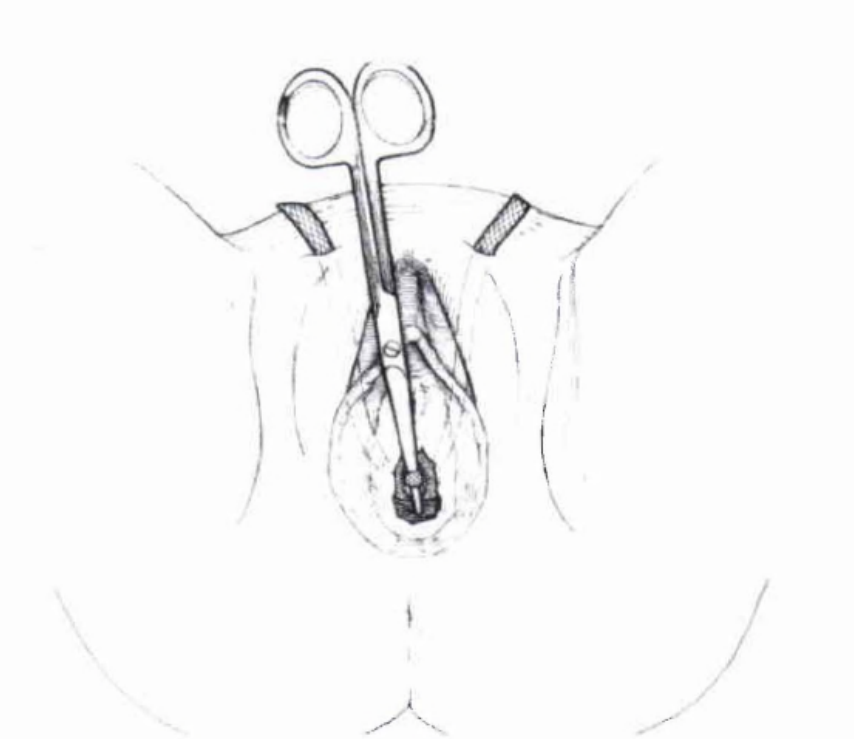
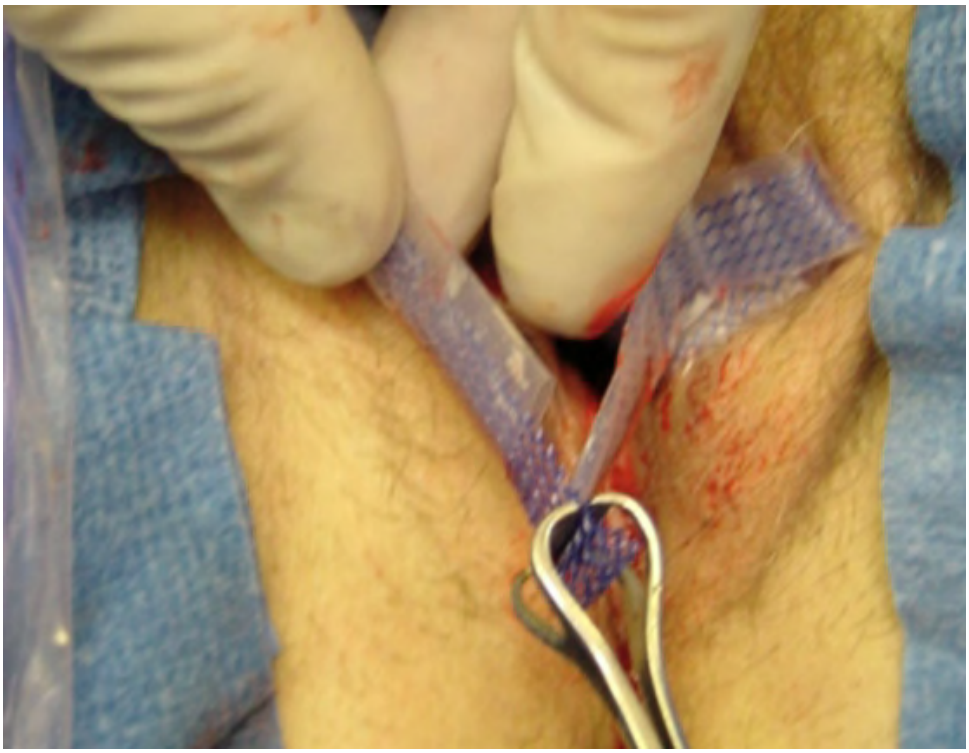


FIG. 4. Tension-free vaginal tape placement and tension adjustment using Metzenbaum scissors as a spacer. (With permission from Urology, 56:28, 2000.)

The TVT operation differs from both retropubic urethropexy and the bladder neck suspension in that it uses a Prolene mesh graft to accomplish the repair. We were concerned that using a foreign body graft would add the potential for infection and impaired healing of the repair. These complications were not observed in our study patients. We believe that the TVT technique minimizes the potential for their occurrence because the sling is placed without excessive tension, and minimizes the risk of exposure to vaginal ecosystem by the plastic sheath. Tensioning methods primarily used for the TVT-O, such as the babcock technique, are effective and recommended.



TVT and TVT_O are Reasonably Safe for its Intended Use, the Benefits Outweigh the Risks, and Complications are Acceptably Low Compared to Alternative Procedures.

TVT and TVT-O are reasonably safe for its intended use for treating stress urinary incontinence. The benefits and utility of TVT and TVT-O significantly outweigh the potential risk of harm, especially when compared to the peer-reviewed literature on the Burch and Autologous Fascial Slings. The major complications of hitting the bowel or a vessel with TVT are rare, and, are in fact lower than laparoscopic procedures. Baggish reported a perforation rates ranging from 2-23% with diagnostic laparotomies, and major vessel injuries in 0.5/1,000 cases. (Baggish – How to Avoid Injury to the Bowel During Laporoscopy, July 2008). One of the main benefits of the many RCTs evaluating TVT is that clinical studies have confirmed the efficacy in patients with a variety of symptoms, including: various ages, BMIs, mixed incontinence, ISD, overactive bladder, primary incontinence, and recurrent incontinence. TVT also allowed surgeons and patients to treat SUI through small vaginal incisions with local anesthesia and without anchors or suture fixation, instead of undergoing an open abdominal Burch or Autologous fascial sling procedure which requires a large abdominal incision and general anesthesia.

The Prolene polypropylene mesh used in the TVT and TVT-O has withstood the test of time and has set the bar as the state-of-the-art Amid Type I macroporous mesh and has been

subjected to rigorous tests and studies as a suture and a mesh. The large pores of TVT and TVT-O are appropriate for the 1.1 cm wide strip of mesh designed to provide the necessary support under the midurethra. The sheath covering the TVT and TVT-O protects the mesh from stretching by carrying the load during passage and tension-free adjustment, while also reducing the risk of infection. This low risk of infection allows for TVT and TVT-O to be used all over the world without concern of infections associated with abdominal procedures in a variety of clinical settings. Moreover, TVT and TVT-O are cost-effective and eliminates the need to harvest autologous material or subject the patient to risk of infection and other viruses from cadaveric or xenograft materials. TVT is durable and provides a consistent repair, unlike a patient's own tissue, which can be unpredictable.

Most importantly, TVT and TVT-O are reproducible techniques that are easy to teach and easy to learn. The consistent high cure rates and low complication rates with TVT and TVT-O have been repeatedly duplicated and confirmed by consistent level 1 clinical data. The intraoperative benefits are that the procedure is quicker (20-30 minutes) compared to alternative procedures, which reduces complications such as DVT, is less invasive as it requires small incisions instead of a large abdominal incision, provides standardized and immediate feedback on incontinence based on cough test under local anesthesia, and quicker return to work, normal activities, and exercise. These are some of the reasons, along with the large body of level 1 RCTs and long-term data confirming the safety and efficacy of TVT, why surgeons and professional societies consider TVT and TVT-O to be the standard of care, gold standard, first-line, primary surgical treatment option for patients with all types of stress urinary incontinence.

TVT was a revolutionary procedure that was state of the art at the time it was introduced in the United States in 1998. This doctor-driven device that was developed by doctors, studied by doctors, used by doctors to treat women with stress urinary incontinence, and supported by Urologists, Gynecologists, and Urogynecologists. The excellent safety and efficacy results of Dr. Ulmsten's initial studies on TVT and Dr. de Leval's initial studies on TVT-O have been repeatedly duplicated in numerous clinical studies from all over the world, by skilled and novice surgeons, and in patients with varying symptoms of incontinence. This shows that any financial bias Ulmsten or de Leval might have had does not have an impact on the vast body of literature showing consistent results. Similarly, Professor Ulmsten passed away in 2004, so his financial bias would be removed from the 7, 11, and 17 year follow-up studies.

TVT has replaced alternative procedures as the gold standard, first-line, surgical option for treating stress urinary incontinence, mixed incontinence with primary stress component, and a low urethral pressure. The major medical professional societies support the position that synthetic, polypropylene, Amid Type I midurethral slings are the preferred surgical treatment option for stress urinary incontinence. My colleagues and the largest medical societies have embraced midurethral slings, such as TVT, and consider them to be the gold standard, first-line treatment for treating stress urinary incontinence both in the United States and worldwide. I have not seen a resurgence of the Autologous fascial sling in my practice or community.

The TVT and TVT-O were appropriately designed for its intended use of treating SUI. The properties of the TVT mesh are appropriate and desired for the intended use of treating stress urinary incontinence. The TVT mesh is classified as an Amid Type I, macroporous, polypropylene, monofilament mesh, and its safety profile is supported by numerous long-term clinical studies and RCTs. The vast body of clinical literature evaluating TVT and TVT-O has shown that the design of TVT is appropriate and desired as a result of the excellent results regarding safety and efficacy. The way the mesh is cut does not have a clinically significant impact on the mesh in vivo. The TVT mesh is such that the 1.1cm width of tape allows for sufficient construction of pores that are able to provide the necessary support under the midurethra. The TVT mesh is appropriate for handling and lays flat under the midurethra. The theory that a 1.1cm strip of a lighter weight, larger pore mesh would provide the same lasting support without roping, curling, or causing retention is unfounded and not supported in the current clinical literature. Randomized clinical trials evaluating meshes for the treatment of SUI do not support the theory that a change in the design of TVT would reduce or eliminate complications related to treatment of SUI. I am aware that Ethicon evaluated a lighter weight, partially absorbable mesh called TOPA, but the project was unsuccessful because the mesh was too stretchy. I am also familiar with poor clinical results from when surgeons used Vypro for pelvic floor repairs. I am familiar with the Okulu study using lighter weight partially absorbable meshes, such as Ultrapro and Vypro with a different surgical technique and without protective sheaths. Although this study did not compare materials directly to TVT, they showed similar success rates and complication rates that do not appear any better than TVT. Further, Dr. Rosenzweig and other plaintiffs' experts who cite the Okulu study in support of Ultrapro as the safer alternative design do not seem concerned that the mesh was hand-cut, similar to mechanically cut mesh. Ultrapro for the use of a sling has not been scientifically validated. Ethicon submitted a 510(k) application for TOPA, which is made from the same material as

Ultrapro, but the FDA rejected the application. Additionally, Ethicon performed cadaveric studies that demonstrated a reaction between the sterilized partially absorbable Monocryl sticking to the sheath which made the mesh too stretchy and not suitable for treating stress urinary incontinence. A survey also indicated that the majority of surgeons did not see any benefit to introducing a partially absorbable sling to the market.

The pore size and weight of TVT mesh used in TVT retropubic and TVT-O are appropriate and acceptable. TVT mesh is considered by Gynecologists, Urologists, and Urogynecologists as an Amid Type I macroporous mesh. The Amid Type I classification is the generally accepted classification for biomaterials; not the effective porosity theory adopted by plaintiffs' experts. TVT is often referred to as a large pore, lightweight mesh. TVT has been studied for over 17 years and has proven to be safe and effective in a variety of patients with similar results from a wide range of surgeons and patients. A significant number of RCTs, long-term studies, and Cochrane Reviews, and Systematic Reviews from SGS have shown that TVT is reasonably safe for its intended use. RCTs evaluating lighter weight, larger pore meshes have not shown a statistically significant reduction in frequency or severity of complications.

Moalli and colleagues described the textile properties of five synthetic meshes compared to Ethicon's TVT and TVT-O mesh. The pore size of the TVT mesh reported in the Moalli 2008 study was the largest pore size at 1,379 microns. It's important to note that 1,379 microns is significantly larger than the Amid Type I threshold of 75 microns that is necessary for proper tissue integration and resisting infection[12].

Table 1 Textile properties (including load at failure) provided by the manufacturers listed at the top (AMS, American Medical Systems) describing the different meshes tested in this study

Mesh type	Gynecare	Boston Scientific	AMS	Bard	Caldera	Mentor
Mesh thickness	0.63 mm	0.66 mm	0.66 mm	0.62 mm	0.48 mm	0.27 mm
Pore size	1379 μm	1182 μm	1000 μm	1160 μm	698 μm	374 μm
Fiber size (diameter)	0.15 mm	0.15 mm	0.15 mm	0.13 mm	0.15 mm	0.08 mm
Weight (g/m^2)	100	100	110	81	140	70
Relative porosity	53.9%	57.7%	52.1%	N/A	68.2%	N/A
Load at failure	70 N	70 N	65.6 N	60 N	70 N	76 N
Mesh edges/features	Tanged	Tanged/heat sealed midsection	Tanged/tensioning suture	Tanged	Not tanged	Not tanged; sealed edges

[12] Moalli,, Tensile properties of five commonly used mid-urethral slings relative to the TVT. Int Urogynecol J (2008) 19:655 663.

Similarly, in 1997, Iglesia and colleagues compared the properties of the most commonly used synthetic meshes used for gynecologic procedures and described the difference in pore sizes of various meshes, distinguishing the pore size of Prolene as being more than twice as large as Marlex at 1,500 microns and 600 microns, respectively.[13] Iglesia also demonstrates the commonly known risks associated with graft materials as tables 2-5 document complications that had been reported in the literature prior to 1997, including: obstruction, voiding dysfunction, poor vaginal healing, urethral erosion, partial removal, transurethral resection of mesh, removal for abscess, bladder erosion, graft infection, vaginal erosions, suture exposures, voiding dysfunction, midvaginal band, groin sinus, infected sinus, persistent discharge with removal, sling revision for retention and obstruction, removal for erosion/infection, stitch abscess, vaginal sinus tracts, removal for vaginal fistula, rejection, dyspareunia, and vaginal erosion 4 years out.

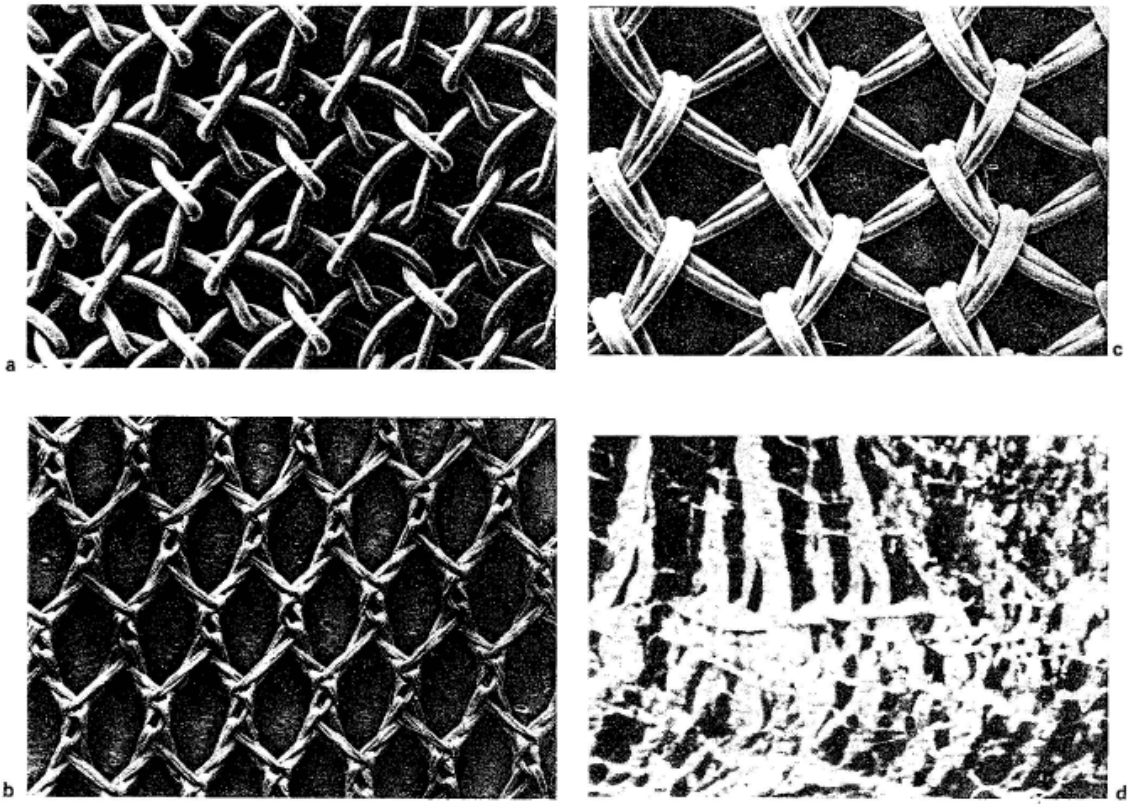


Fig. 1. Pore configuration. **a** Marlex; **b** Mersilene; **c** Prolene; **d** Gore-tex.

A complication that might occur with TVT or TVT-O does not make them defective. No device or procedure is perfect, but TVT is the best option for surgeons treating patients with

[13] Iglesia, The Use of Mesh in Gynecologic Surgery. Int. Urogynecol. J (1997) 8:105-115.

stress urinary incontinence. Complications can occur due to surgical technique and various patient factors, which is true with any procedure. TVT fraying is not a design defect. The frayed edges have been suggested to help with tissue integration and there are no clinical implications associated with mesh fraying. There are no studies that have shown an increase in complications due to fraying of mechanically cut mesh. The laser cut TVT-Exact also has the potential to fray if stretched without the sheath under excessive forces not seen in the operating theater. The sheath is a critical design component for preventing the possibility of mesh stretching during implantation. Both mechanically cut and laser cut TVT meshes have the potential to fray if they are misused or stretched beyond clinically relevant forces under extreme testing. Out of the hundreds of RCTs published on TVT, I have not seen any reference to the properties or design of the mechanically cut TVT or TVT-O causing a statistically significant increase in complications. When implanted properly and as intended, the mechanically cut TVT and TVT-O lays flat and does not cause a statistically significant increase in retention compared to laser cut TVT.

A 2006 study comparing a laser cut mesh sling to mechanically cut TVT showed a statistically significant increase in mesh erosions associated with the laser cut mesh, which some authors have hypothesized is related to the laser cut mesh being stiffer. Similarly, Neuman found 7.9% dyspareunia rate in the TVT-Secur (laser-cut) arm as opposed to 0% in the TVT-O (mechanically cut) arm, which resulted in the lead author theorizing that “Dyspareunia associated with the TVT-SECUR procedure might be explained in part by the rigidity and reduced flexibility of the synthetic polypropylene implant because it is laser cut, which tends to result in a stiff tape edge. As a result, the overlying vaginal mucosa is constantly traumatized, much more than it would be with use of mechanically cut tape.” Additionally, two Ethicon engineers authored documents suggesting laser cut mesh lays flatter than mechanically cut mesh, reduces roping, fraying, curling, and retention, and is three times stiffer than mechanically cut mesh, which suggests the theory that a stiffer mesh causes an increase in complications such as dyspareunia and erosion. However, these theories are unfounded and not supported by the clinical literature. The TVT meshes behave the same within the physiological range, which is how the meshes are intended to be used. I have not seen this correlation published in the clinical literature, nor did I see a difference in retention rates in any of my studies or patients after mechanically cut or laser cut TVT or TVT-O. I have performed a search of the literature and have not found any clinical studies that show clinically significant risks associated with mechanically cut mesh fraying, roping, curling, particle loss, cytotoxicity, or degradation.

All surgeries have risks. Mesh exposures and erosions, complications unique to TVT and TVT-O compared to native tissue repairs, are complications that can occur on average in about 1-3% of women, but this complication is generally easy to manage and is often asymptomatic. Native tissue repairs can also result in suture exposures, erosions, and complications at the graft site. Inflammation is a necessary mechanism of the healing process, not a complication.[14]

Multiple long-term studies on TVT would have been mechanically cut TVT, and they have shown that TVT remains safe and effective for over 10 years. Similarly, most of the long-term studies on TVT-O would have used mechanically cut TVT-O based on the recruitment period for the studies. Particle loss does not cause clinically significant complications. Similarly, particle loss, roping, fraying, and curling are not defects associated with TVT. I have not seen particle loss in my practice in the thousands of TVTs I have placed, nor have I seen any medical literature that has shown a clinically significant or statistically significant increase in complications due to hypothetical particle loss in humans. Stretching the TVT mesh to 50% elongation is not consistent with its intended clinical use or the physiological forces under the midurethra. Further, particle loss does not occur at any level of clinical significance when TVT is used for its intended clinical use. TVT does not undergo clinically significant degradation that impacts patients clinically. The theory that degradation increases the risk of infection is unsupported by the clinical literature and the extremely low culture-positive infection rates associated with TVT. Infections are more common with Burch and Autologous fascial sling procedures.

Everything has the potential to degrade over an extended period of time, but Prolene used in TVT is the most resistant material to degradation that has been evaluated and validated by surgeons and the FDA as a suture and as a mesh. I have never attributed theoretical degradation as the cause of any complications in my patients, nor have I seen a clinical study confirming a causal increase in complications that were attributed to degradation or particle loss. I am not aware of any professional organizations or colleagues who have expressed a concern with an increase in complications due to degradation associated with TVT. I have explanted various synthetic meshes as well as TVT, and I have not seen any TVT meshes that were degraded. I performed a PubMed search for TVT and particle loss/particles and the only

[14] Falconer (2001).

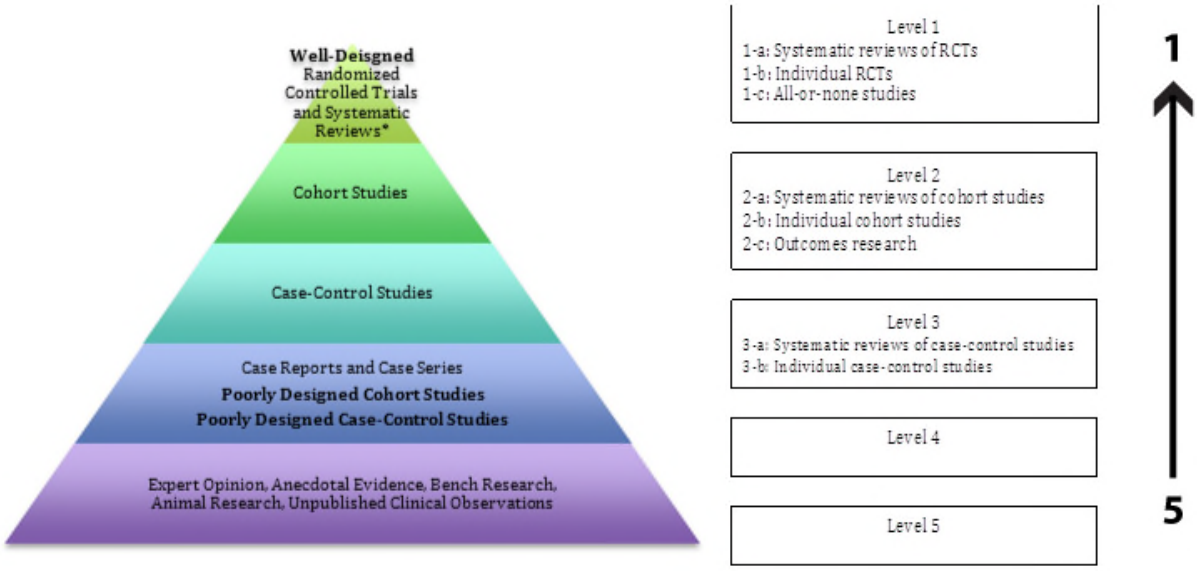
citation was the Pariente mechanical loading study, which was designed to intentionally strain the mesh and is not consistent with clinical use. I was unable to find any randomized controlled trials that shows TVT degrades over time in the body or that there are clinically significant risk of degradation. Outcome data from long-term clinical studies evaluating TVT have not shown that degradation has a clinical impact on efficacy or safety, as both objective and subjective cure rates remain high and complications remain low.

I have found it easier to perform uretholysis on patients who have a synthetic midurethral sling than patients who have had an Autologous fascial sling because I am able to identify the mesh during lysis, whereas I am not able to easily identify the Autologous sling. This creates an increased risk of cutting into the urethra, bladder, and surrounding tissues. When I have had to re-operate on a patient who has had a TVT, I have noticed that the tissues have fully integrated into the open pores of the mesh, which results in the intended healing to form the necessary support to treat incontinence. Likewise, I have not visualized mesh particles that had separated from the TVT, nor have I observed shrinkage of the TVT or degradation. Several clinical studies have concluded that TVT does not shrink or contract.[15]

The risks of alternative procedures, such as Burch Colposuspension and Autologous Fascial Slings, significantly outweigh the benefits for the first-line treatment of uncomplicated stress urinary incontinence. Most OBGYN Residencies rarely teach alternative procedures, such as Burch Colposuspension and Autologous Fascial Slings. These procedures are typically taught in advanced FPMRS fellowships as they are seldom performed today. Most residency programs and FPMRS fellowships teach TVT and midurethral slings as the first-line surgical treatment for stress urinary incontinence. There are times when Burch or Autologous Fascial Sling procedures can be an appropriate option, such as performing a Burch when the patient is undergoing an open abdominal procedure to treat prolapse or performing an Autologous fascial sling as a salvage procedure for a patient who had a failed midurethral sling or do not want mesh. Even as a second operation for recurrent SUI, I frequently recommend a TVT. It has been over five years since I performed a Burch Colposuspension for the treatment of SUI, and I have performed one Autologous Fascial Sling in the last five years. There are occasions when the Burch procedure could be appropriate, such as open procedures treating concomitant pelvic organ prolapse.

[15] Lo (2004), Lukacz (2003), Nilsson (2013), Rinne (2011)

TVT has proven to be a revolutionary in treating stress urinary incontinence and has been subjected to rigorous scientific scrutiny and validation through many level 1 studies, unlike alternative procedures to treat SUI which lack robust validation of evidence based medicine. The medical literature related to Autologous fascial slings and the Burch Colposuspension mainly consists of level 4 case series from highly skilled surgeons as opposed to level 1 RCTs. Level 3 and 4 studies are important in the scientific and feasibility process, but they inherently lack the standardization and scientific verification that is shown in the clinical literature related to TVT. Results from case series are often not reproducible by other surgeons.



TVT is revolutionary compared to Burch and Autologous Fascial Slings because of the ease of the procedure, the short operating time, the quick return to normal activities, the cost-effectiveness of the procedure, extremely low incidence of catheterization post-operatively for bladder drainage, the standardization of the procedure, the easy learning curve, the low complications, the high success rates. Both the Burch and Autologous fascial sling procedures are not easy to perform. The Autologous fascial sling utilizes a very similar surgical approach to the TVT and passes through the same tissues. The open dissection associated with the Burch and Autologous fascial sling creates additional complications, such as wound healing problems, blood loss, and damage to vessels and ureters. The TVT mesh does not migrate in vivo. By contrast, surgeons performing a Stamey procedure would utilize 1 cm tube of knitted Dacron buttresses to help prevent the suture from tearing through the tissues.[16]

[16] Atlas of Pelvic Anatomy and Gynecologic Surgery by Baggish and Karram, 2001

TVT has equivalent, if not superior, success rates over the long-term compared to Burch and Autologous Fascial Slings. Repeat procedures for recurrence are extremely low for TVT, and they are often easily handled without complications. Repeat treatments of Autologous slings or Burch procedures are much more invasive and difficult on the surgeon and patient. Burch Colposuspension has been noted to have decreasing efficacy and approximately a 3% persistent dyspareunia rate. Pain and dyspareunia are reported with Burch and Autologous Fascial Slings.

All surgeries have risks. These risks associated with TVT are similar to those associated with Burch and Autologous Fascial Sling, but are less severe. The severity of voiding dysfunction, time under anesthesia, degree of surgical dissection, reproducibility of results, and urinary retention associated with Autologous fascial slings is why I switched to TVT. TVT is minimally invasive procedure compared to Burch and Autologous Fascial Slings, both of which involve an abdominal incision. Laparoscopic Burch procedures have not shown to be as efficacious as open Burch or midurethral slings. Additionally, the literature on the laparoscopic Burch procedure is inconsistent at best. The complication rates associated with TVT are extremely low; especially when compared to alternative procedures. Compared to the Burch and Autologous Fascial sling, the percentage of complications associated with TVT are all well-documented, extremely low, and acceptable to surgeons and patients. TVT rarely causes chronic pain that lasts beyond 6 months.

All surgical procedures carry the risks of bleeding, infection, scar tissue formation, damage to other organs, such as, bowel, ureters, blood vessels, that may or may not be recognized at the time of surgery. In incontinence surgery, there are also risks of de novo dyspareunia, de novo urgency, urinary retention, voiding dysfunction, scarring, and pelvic pain that can be acute or chronic. Specifically to Burch, is enterocele formation that resulted in the literature of prophylactic treatment of the cul-de-sac, and also rare instances of osteitis pubis, that in the worst case scenario resulted in symphysiotomy. Unique complications associated with Autologous fascial slings, but not with TVT, include hernia at the harvest site, pain at the harvest site, and infection at the harvest site. Based on my clinical experience and discussions with other surgeons at various meetings, patients with TVT do better than patients with native tissue repairs.

I am unaware of an ICD code for chronic mesh pain syndrome or mesh cripples based on accepted WHO diagnosis codes. These terms are not scientific and are not consistent with the complications associated with TVT in the peer-reviewed literature or in my clinical practice. Post-operative chronic pain and de novo dyspareunia are rare complications associated with TVT. Chronic pelvic pain and dyspareunia are common conditions among the general population, even for women who haven't undergone pelvic surgery. Chronic pelvic pain is often multi-factorial. The baseline rates for women with chronic pelvic pain and dyspareunia in the general population are common, even for women who have not undergone surgical pelvic floor treatment. [17]

TVT is the best and most studied surgical procedure to treat stress urinary incontinence. The results of Professor Ulmsten's and Nilsson's 17 year follow-up study are consistent with the general body of literature published on the safety and efficacy of TVT. There have been over 2,000 publications on synthetic midurethral slings, well over 100 randomized controlled studies on TVT, and several Cochrane Reviews, meta-analyses, systematic reviews, and registries. The FDA performed a literature review of midurethral slings and found that they were safe and effective. Unfortunately, the effect of attorney advertisements has caused significant confusion among patients. Many patients have expressed interest in filing a lawsuit even though they are not injured. Now, when I speak to patients about slings, I have to spend more time talking about the legal advertisements versus the evidence based medicine. I have had a number of patients approach me to have their mesh slings removed because they said their attorney told them they would get money if they had their mesh removed.

TVT is not only the market leader amongst procedures and other devices designed to treat SUI, but it is the most studied suburethral sling and is the gold standard worldwide for the primary treatment of stress urinary incontinence. The Prolene polypropylene fibers that are used to make the TVT have proven to be a safe and acceptable implantable surgical material, even in clean-contaminated areas of the body. Surgeons have been using Prolene sutures since 1969 and Prolene hernia mesh since 1974. The biomechanical properties of Prolene have been well-studied for almost 50 years. TVT is made from the same Prolene fiber which was approved by the FDA as a new drug. TVT has been studied in a variety of patients in many surgeons' hands and has proven to be a standardized procedure with consistent results of success and low complications. Complications associated with TVT are usually easy to

[17] Jamieson (1996); Mathias (1996)

manage. Additionally, based on my clinical experience, training, and review of Ethicon's in vitro testing and the clinical literature, the Prolene mesh used in TVT is not cytotoxic and does not cause cell death.

TVT is tension-free compared to alternative procedures. Surgeons who have performed Autologous fascial slings are familiar with both the retropubic passage and placing slings without tension. Tensioning with the TVT was very standardized with the use of an spacing instrument, the protective sheath, and the ability to perform the cough test or Credé's maneuver to determine the appropriate setting has proven to be a successful objective determination for treating incontinence. The standardized tension-free placement of TVT is much more predictable than the eye-ball technique used for Autologous fascial slings.

As part of the SISTEr study, the Urinary Incontinence Treatment Network analyzed the impact incontinence had on patients' symptoms, activities, and emotional components. In the SISTEr study (Albo 2007), the authors found that: "Urinary incontinence affects an estimated 15 to 50% of women, resulting in a significant medical, social, and economic burden. In 1995 dollars, the annual direct costs of incontinence in the United States were estimated to be more than $16 billion. Among women with incontinence, 50 to 80% are identified as having stress incontinence, or involuntary leakage of urine resulting from physical exertion or sneezing and coughing. Although the initial treatment of stress incontinence is often nonsurgical (behavioral therapy, pelvic-floor exercises, or incontinence devices), surgical treatment is considered for patients who are bothered by persistent symptoms. An estimated 4 to 10% of women in the United States undergo surgery intended to restore continence, and this rate has increased steadily during the past 20 years." Likewise, they found that the advantage of high cure rates with Autologous slings "may be offset by increased obstructive complications, such as voiding dysfunction and urge incontinence."

TABLE 2
Frequency of symptoms and related treatment expectations: results from the ISEQ

ISEQ domain and questions	Women who answered "yes" (%)	Expectation (Percent of women who answered "yes" and reported high expectations)[a]
Symptoms		
Do you currently experience any of the compared with symptoms?		
Urine leakage	96	98
An urgency to urinate such that you fear not making it to the bathroom in time	70	92
Frequent urination	74	83
Any other symptoms	26	93
Activities		
Do you currently limit any of the listed activities because of your bladder?		
Physical activities (eg, housework, yard work, going for a walk, dancing, jogging, golfing)	72	93
Social activities (eg, visiting friends, vacationing, going to church or temple)	33	88
Sexual activity	44	87
Any other activities	22	92
Emotional		
Are you bothered by feelings of embarrassment, helplessness, frustration, and/or depression because of your bladder problems?	88	95

Mallett. Patient expectations of incontinence surgery. Am J Obstet Gynecol 2008.

Early Studies Confirmed Ulmsten's Results:

The objective and subjective cure rates reported in Cody's 2003 systematic review below show similar results to Ulmsten's initial studies, which have been duplicated over and over again in a variety of patient-types, clinical settings, surgeons, and institutions. The 2003 Cody Systematic Review found that "as would be expected from the less invasive approach of TVT compared with colposuspension and other abdominal procedures, [TVT] is quicker to perform, can be carried out under local anaesthesia, although it is not uncommon for women to have general anaesthesia, and is followed by a shorter length of stay and more rapid return to usual activities."

Debodinance[18] published 87% objective cure rate in 256 patients after 3 years' follow-up in 2002, and 95% of patients reporting being very satisfied or satisfied. Also, the authors did not observe any defective healing or rejection phenomenon. "This minimally invasive technique was perfectly well tolerated as a result of the small vaginal incision and of protecting the tape with plasticized sheaths. Using different materials and different methods, we encountered intolerance in 9-28% of the cases." The authors reported other studies showing similar results to Ulmsten's initial cure and complication rates:

[18] Debodinance (2002): Tension-free vaginal tape (TVT) in the treatment of urinary stress incontinence: 3 years experience involving 256 operations.

TABLE 14 *Cure and improvement rates (case series)*

Study	Length of follow-up (months)	Cure rate				Additional women who reported improvement			
		Subjective		Objective		Subjective		Objective	
		No.	%	No.	%	No.	%	No.	%
Case series ≥4 years follow-up									
Jomaa, 2001[71]	60 (48–78)[a]	59/62	95	59/62	95	2/62	3	2/62	3
Nilsson, 1998,[41] 2001[76]	56 (48–70)[a]	72/85	85	72/85	85	9/85	11	9/85	11
Nilsson, 2001[75b]	56 (48–70)[a]		86	NR			14	NR	
Rezapour, 2001[79b]	48 (36–60)[a]	36/49	74	36/49	74	6/49	12	6/49	12
Rezapour, 2001[80b]	48 (36–60)[a]	NR		68/80	85	NR		3/80	4
Rezapour, 2001[81b]	48 (36–60)[a]	28/34	82	28/34	82	3/34	9	3/34	9
Case series ≥3 years follow-up									
Jomaa, 2000[69]	36	21/25	84	21/25	84	4/25	16	4/25	16
Migliari, 1999[74b]	36	44/50	87	NR		NR		NR	
Olsson, 1999[78]	36	46/51	90	46/51	90	3/51	6	NR	
Ulmsten, 1999[84b]	24–36	NR		43/50	86	NR		NR	
Case series ≥2 years follow-up									
Bettin, 2000[66]	24	NR		19/22	86	NR		NR	
Jomaa, 2001[70]	Up to 24	30/32	94	30/32	94	1/32	3	1/32	3
Kinn, 2001[72]	24	60/75	80	NR		7/75	9	NR	
Liapis, 2001[73]	24	45/50	90	45/50	90	2/50	4	2/50	4
Ohkawa, 2001[77]	24	173/203	85	132/203	65	NR		NR	
Tunn, 1999[83]	24	NR		13/15	87	NR		2/15	13
Ulmsten, 1996[25b]	24	63/75	84	63/75	84	6/75	8	6/75	8

[a] Mean (range).
[b] One of the originators of the technique (Ulmsten) was involved in these studies.

In the Ward/Hilton RCT comparing TVT to Burch colposuspension, the average duration of operation was shorter for TVT, estimates from the comparative studies ranging from 20 to 40 minutes (mean of 30 minutes in case series) compared with 35–58 minutes for open Burch colposuspension. Laparoscopic Burch colposuspension took the longest at between 60 and 113 minutes.

TABLE 16 *Complications from the Ward/Hilton trial*[52]

Complication	TVT (n = 170)	Colposuspension (n = 146)	p-Value[a]
Vaginal perforation	5 (3%)	0	0.06
Wound infection	4 (2%)	10 (7%)	0.06
Fever	1 (1%)	7 (5%)	0.03
Deep vein thrombosis	0	3 (2%)	0.10
Incisional hernia	NA	3 (2%)	
Retropubic haematoma	3 (2%)	0	0.25
Vascular injury	1	0	1.0
Tape erosion	1	NA	
Urinary tract infection (in the 6 weeks following surgery)	38 (22%)	46 (32%)	0.07

[a] Fisher's exact test.

Other Complications from Early Studies:

Table 19 from Cody's 2003 Systematic Review shows mean late complication rates from various TVT studies reporting low and acceptable complication rates, including: sling infection (0%), defective healing (0.5%), postoperative pain (2.3%), voiding dysfunction (0%), dyspareunia (0%), tape rejection (0%), tape erosion (1.1%), urinary retention (6.2%), infection (0.7%), and reoperation for incontinence (1.4%).

TABLE 19 *Later complications of TVT (case series)*

Complication	No. of studies for which relevant data are reported (no. of women studied)	Median rate (%) (IQR)[a]	Mean (%)
Sling infection	3 (225)	1.0 (0)	0
UTI[a]	19 (2601)	6.7 (3.1 to 7.9)	5.5
Defective healing	19 (2974)	0	0.5
Thrombosis[b]	3 (1795)	0.5 (0.3 to 0.6)	0.2
Postoperative pain	4 (375)	3.0 (0.9 to 5.3)	2.3
Voiding difficulty	5 (380)	1 (0 to 4.4)	8.3
New urge symptoms/detrusor overactivity	27(1644)	4.4 (1.1 to 7.2)	6.6
Voiding dysfunction	7 (402)	0 (0 to 0.4)	0
New/recurrent prolapse	3 (190)	0 (0.0 to 1.1)	1.0
Dyspareunia	3 (206)	0	0
Pain	3 (152)	4.4 (2.2 to 4.4)	2.6
Tape rejection	24 (2895)	0	0
Tape erosion	3 (278)	1 (0.5 to 1.8)	1.1
Recurrent UTI	3 (191)	1.1 (0.6 to 1.5)	1.0
Readmission	19 (4377)	2.4 (1.4 to 5.0)	2.4
Dysuria	4 (348)	7.9 (7.1 to 8.5)	7.5
Urinary retention	14 (731)	4.4 (0.4 to 9.1)	6.2
Infection	12 (2427)	0 (0 to 0.9)	0.7
Reoperation (for incontinence)	8 (3196)	1.5 (1.3 to 2.4)	1.4

[a] UTI, urinary tract infection.
[b] Two pelvic vein thrombosis, one venous thrombosis.

Early RCTs:

Although Ward/Hilton was the first large population RCT evaluating TVT, there were several published RCTs from 1999-2001.

TABLE 17 *Later complications of TVT (RCT and non-randomised comparative studies)*

Study	Comparator	New urge symptoms/detrusor overactivity					Voiding dysfunction >3 months		Postoperative pain				
		TVT		Comparator		RR[a] [RD][b]	TVT	Comparator	TVT		Comparator		RR [RD]
		No.	%	No.	%				No.	%	No.	%	
Cucinella, 2001[43]	Lap colpo	0/57		0/56		NA	0/57	0/56	NR		NR		NA
Liapis, 2002[47]	Burch colpo	6/36	17	5/35	14	1.17 (0.39 to 3.48) [0.02 (–0.14 to 0.19)]	NR	NR	NR		NR		NA
Atherton, 1999[57]	Burch colpo	1/9	11	3/7	43	0.26 (0.00 to 1.99) [–0.32 (0.74 to 0.10)]	NR	NR	NR		NR		NA
Atherton, 2000[58]	Burch colpo	3/20	15	2/16	13	1.20 (0.23 to 6.34) [0.03 (–0.20 to 0.25)]	NR	NR	NR		NR		NA
Han, 2001[45]	Burch colpo	NR		NR		NR	NR	NR	23/25	92	23/25	92	1(0.85 to 1.18) [0.00 (–0.15 to 0.15)]

In a 2015 meta-analysis by Seklehner[19], the authors performed a systematic literature review limited to 17 RCTs of 2,995 patients with minimum follow-up of 1 year and Amid Type 1 grafts. Their conclusion was that "Retropubic midurethral slings showed better objective and subjective cure rates than transobturator midurethral slings." The authors noted that "since its introduction, sling procedures have replaced traditional repairs such as Burch colposuspension due to their efficacy, low rates of complications and morbidity, and short learning curve." They noted that "Synthetic midurethral slings currently represent the mainstay treatment for female SUI."

Nationwide Registries:

Kuuva (2001):[20] Evaluated 1,455 patients across 38 hospitals in Finland and concluded that TVT was safe.

Results. Among the 38 hospitals there were four university, 13 central and 21 local hospitals. The total number of operations was 1455. The incidence of bladder perforation was 38/1000, that of intra-operative blood loss over 200 ml 19/1000, of major vessel injury 0.7/1000, of nerve injury 0.7/1000, of vaginal hematoma 0.7/1000 and of urethral lesion 0.7/1000. The incidence of minor voiding difficulty was 76/1000, that of urinary tract infection 41/1000, of complete postoperative urinary retention 23/1000, of retropubic hematoma 19/1000, of wound infection 8/1000 and of vaginal defect healing 7/1000. No case of tape rejection or life threatening complication occurred and the incidence of complications requiring laparotomy was 3.4/1000. The ratio of number of complications to TVT operations performed did not vary significantly between different hospital types ($p>0.05$).
Conclusion. The TVT procedure is a safe method for the treatment of stress urinary incontinence provided that appropriate training is offered.

[19] Seklehner (2015): A Meta-Analysis of the Performance of Retropubic Midurethral Slings versus Transobturator Midurethral Slings.
[20] Kuuva (2001): A nationwide analysis of complications associated with the tension-free vaginal tape (TVT) procedure.

Additionally, Tamussino (2001):[21] Published results of 2,795 TVT patients from 55 centers in the Austrian registry and found major complications to be rare. A total of 2.4% of patients required reoperation for reasons related to the TVT operation.

Schraffordt (2006)[22] published results of 809 women with 3 years' follow-up in the Netherlands TVT registry. "The tension-free vaginal tape (TVT) has become the first choice for surgical treatment of SUI in women." The procedures took place in 41 different hospitals by 54 gynecologists and urologists. 92.9% of women who underwent prior surgery reported improved subjective cure, and 92.6% of women with no prior surgery reported improved subjective cure. The 2-year results[23] concluded that TVT in conjunction with prolapse surgery can be safely performed with good results. The 24 month objective cure rates reporting no leakage or improved were 87.5% and 96% for concomitant surgery and no concomitant surgery, respectively. "With the TVT as first choice for incontinence surgery, TVT in conjunction with other pelvic surgery is becoming more popular; especially because the two can be performed in one session without an abdominal incision." "Until 1995, the "gold standard" for SUI surgery was the Burch colposuspension. Recently, TVT has become the first choice as surgical treatment for SUI in many women." At 2 year follow-up, 80-88% reported cure of their stress incontinence.

M. Nilsson (2012)[24] reported 12-month post-operative data from 2,059 TVT patients from the Swedish registry, finding 76% much improved, and 16% improved. Patient satisfaction results showed 67% of TVT patients were very satisfied and 22% were satisfied.

Svenningsen (2013)[25] reported 10-year results after TVT from the Norwegian registry. Objective cure rate was 89.9%, subjective cure rate was 76.1%, and 82.6% of patients stated they were "very satisfied" with their surgery. "Midurethral slings are currently considered the gold standard in the surgical treatment of SUI."

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[21] Tamussion (2001): The Austrian Tension-Free Vaginal Tape Registry. Tamussino (2001): Tension-free Vaginal Tape Operation: Results of the Austrian Registry.
[22] Schraffordt (2006): The effectiveness of tension-free vaginal tape (TVT) and quality of life measured in women with previous urogynecologic surgery: Analysis from the Netherlands TVT database.
[23] Schraffordt (2007): Result of the tension-free vaginal tape in patients with concomitant prolapse surgery: a 2-year follow-up study. An analysis from the Netherlands TVT database.
[24] Nilsson (2012): Female Urinary Incontinence: Patient-reported outcomes 1 year after midurethral sling operations.
[25] Svenningsen (2013): Long-term follow-up of the retropubic tension-free vaginal tape procedure.

Table 2 Primary objective and subjective outcome measures

Results	6–12 months Percentages (numbers/total/missing info)	10 years Percentages (numbers/total/missing info)	*p* value*
Objective results[a]	(*N*=327)	(*N*=327)	
Objective cure rate	90.2 (285/316/11)	89.9 (285/317/10)	0.86
Objective failure rate	9.8 (31/316/11)	10.1 (32/317/10)	0.86
	(*N*=483)	(*N*=483)	
Re-operation rate	0.6 (3/476/7)	2.3 (11/476/7)	0.008
Subjective results[b]	(*N*=480)	(*N*=472)	
Subjective cure rate	_[f]	76.1 (359/472/0)	
Subjective improved rate[c]	_[f]	94.1 (444/472/0)	
Subjective failure rate[d]	_[f]	5.9 (28/472/0)	
Treatment satisfaction rate[e]	89.1 (407/457/23)	82.6 (389/471/1)	0.006

Table 3 Secondary outcome measures I: complications registered during or immediately following surgery

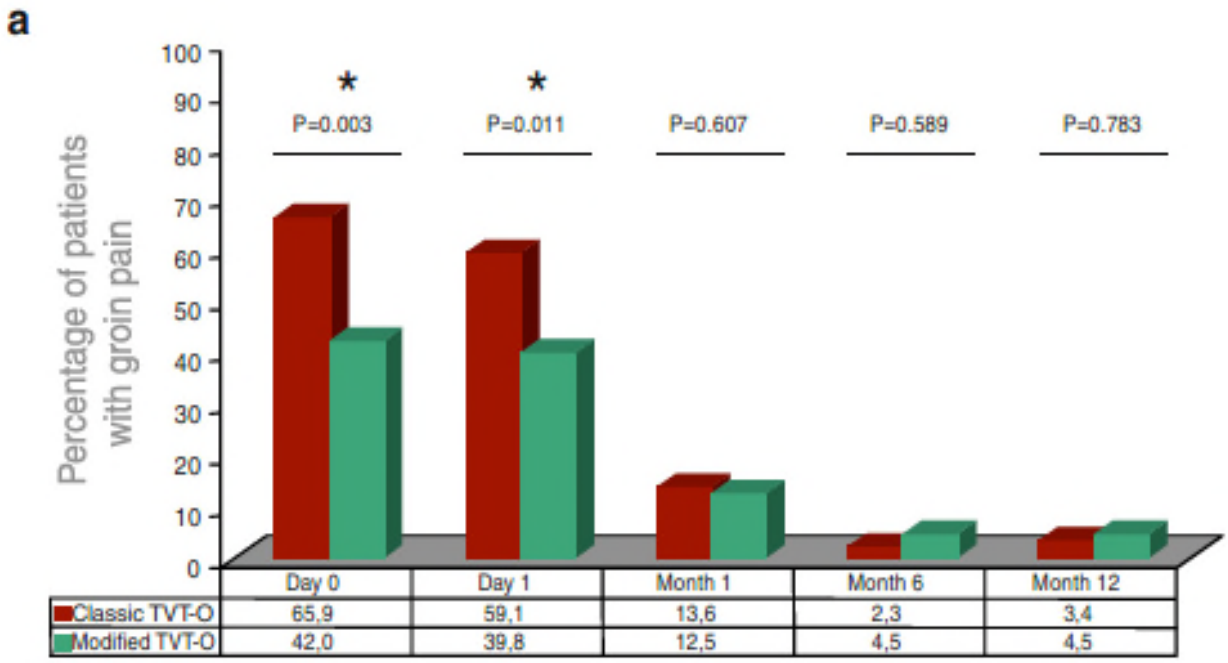
Type of complications	Percentage (numbers/total/missing info)
Total	8.7 (42/483/0)
Hematoma (> 4 cm)	2.5 (12/483/0)
Superficial infection[a]	0.6 (3/483/0)
Deep infection[b]	0.8 (4/483/0)
Bladder perforations	1.2 (6/483/0)
Urethral injury	0.2 (1/483/0)
Bowel injury	0.0 (0/483/0)
Major vessel injury	0.0 (0/483/0)
Major bleeding (> 500 ml)	0.4 (2/483/0)
Catheterization>1 week	1.7 (8/483/0)
Catheterization>1 month	1.0 (5/483/0)
Postoperative vaginal mesh exposure	0.6 (3/479/4)
Postoperative sling release	1.9 (9/477/6)

Long-Term TVT-O Studies:

Multiple studies evaluating TVT-O with at least four years' follow-up have demonstrated the long-term safety and efficacy of TVT-O, which is similar to TVT. Liapis (2010) showed 82% cured and 7% improved at 4 year follow-up. Angioli (2010) found a 73% cure rate, 89.2%

negative cough stress test, and 78.4% of patients would undergo the procedure again at five year follow-up. Cheng (2012) showed a 92% objective cure and 90% subjective cure at five year follow-up. Serati (2013) showed a 90.8% objective cure and 90.3% subjective cure at five year follow-up. Laurikainen (2014) showed 86.2% objective cure and 88.6% of patients would recommend the procedure to a friend at five year follow-up. Athanasiou (2014) showed a 90.3% objective and subjective cure rate in the TVT-O group at 7.5 year follow-up. These long-term studies are an example of how TVT-O has a proven safety profile in the long-term.

A 2011 study[26] comparing TVT-O to TVT-Abbrevo, which uses less mesh, showed no significant difference in groin pain after the first post-operative day. This 1 year prospective study be de Leval and Waltregny found that the percentage of patients who reported postoperative groin pain (either unilateral or bilateral) differed significantly between the two procedures on day 0 and day 1 (p=0.003 and p=0.011, respectively), but not thereafter.



[26] De Leval, The original versus a modified inside-out transobturator procedure: 1-year results of a prospective randomized trial. Int Urogynecol J (2011) 22:145-156.

Cochrane Reviews, Systematic Reviews, and Meta-Analyses:

In 2013, Cox published a summary of the recent Cochrane Reviews and determined that midurethral slings have become the new gold standard first-line surgical treatment for women with uncomplicated SUI.[27] The traditional gold standards of Burch retropubic colposuspension and pubovaginal slings are still appropriate treatment options for some patients, but randomized controlled trials have demonstrated that synthetic midurethral slings are just as effective as these traditional procedures, but with less associated morbidity. Synthetic midurethral sling procedures were first developed by Ulmsten in 1995, since which time they have become the most commonly performed procedure for female SUI. The reasons for this are multiple: the procedures are performed relatively quickly, are easy to learn, and have acceptable rates of morbidity. More importantly, there are now long-term data to show that they compare favorably to the traditional methods of surgical repair for SUI detailed above.

Table 1 | Meta-analyses of midurethral slings versus traditional procedures for stress urinary incontinence

Study	Comparison	Subjective success at 12 months	Objective success at 12 months
Rehman *et al.* (2011)[26]	Pubovaginal fascial sling vs midurethral sling	Equal success (n=693) RR 0.97 (95% CI 0.78–1.20)	Equal success* (n=160) RR 1.29 (95% CI 0.45–3.71)
Novara *et al.* (2010)[27]	Midurethral sling vs Burch colposuspension	Equal success (n=400) OR 0.79 (95% CI 0.52–1.21; P=0.27)	Favoured midurethral sling (n=528) OR 0.38 (95% CI 0.25–0.57; P=0.0001)
Novara *et al.* (2010)[27]	Midurethral sling vs pubovaginal sling	Equal success (n=281) OR 1.28 (95% CI 0.74–2.23; P=0.38)	Equal success (n=473) OR 0.8 (95% CI 0.51–1.26; P=0.35)
Ogah *et al.* (2009)[4]	Midurethral sling vs pubovaginal sling	Equal success (n=599) RR 1.03 (95% CI 0.94–1.13)	NR
Ogah *et al.* (2009)[4]	Midurethral sling vs open Burch colposuspension	Equal success (n=729) RR 0.96 (95% CI 0.90–1.03)	Equal success (n=468) RR 1.04 (95% CI 0.94–1.14)

*At >12 months. Abbreviation: NR, not reported.

An analysis of the Cochrane Reviews referenced in Cox's 2013 review shows equal subjective and objective success between midurethral slings, Burch, and Autologous fascial slings, with Novara (2010) favoring the midurethral sling. The Novara (2010) Cochrane Review found midurethral slings to have higher objective cure than Burch Colposuspension. Additionally, Novara found that while cure rates were not statistically significantly different between those who received midurethral slings and pubovaginal slings, whether assessed objectively (OR 0.80, 95% CI 0.51–1.26; P = 0.35) or subjectively (OR 1.28, 95% CI 0.74–2.23; P = 0.38), the pubovaginal sling was associated with higher rates of storage lower urinary tract

[27] Cox (2013): Surgical Management of female SUI: is there a gold standard?

symptoms (OR 0.31, 95% CI 0.10–0.94; P = 0.04) and reoperation (OR 0.31, 95% CI 0.12–0.82; P = 0.02) than midurethral slings.

The Ogah 2009 Cochrane Review evaluated results from 62 trials involving 7,101 patients evaluated the short-term clinical effects of minimally invasive synthetic midurethral sling procedures for the treatment of both urodynamic SUI and clinically symptomatic SUI. Eight RCTs (599 patients) compared synthetic midurethral slings with pubovaginal slings, and the overall subjective cure rate within 12 months was similar between the two (RR 1.03, 95% CI 0.94–1.13). No difference was found in the rate of postoperative voiding dysfunction (10% for the midurethral sling and 13% for pubovaginal slings; RR 0.75, 95% CI 0.38–1.48). Three studies (236 patients) found that patients who received midurethral slings reported less de novo urgency than those who received pubovaginal slings (RR 0.36, 95% CI 0.16–0.79). Operative times were significantly shorter for the synthetic midurethral sling (35 min) than the pubovaginal sling (87 min).

The most recent 2015 Ford Cochrane Review on full-length midurethral slings included 81 trials that evaluated 12,113 women for up to five year follow-up. The Cochrane Review found that the overall rate of adverse events remained low. Overall rates of groin pain were higher in the transobturator group than the retropubic group (6.4% versus 1.3%), and the suprapubic pain rate was slightly higher in the retropubic group than the transobturator group (2.9% versus 0.8%), although the pain was short in duration. The need for repeat incontinence surgery in the long term was less likely in the retropubic group than in the transobturator group. A retropubic bottom-to-top route was more effective than top-to-bottom for subjective cure.

The Ford/Ogah 2015 Cochrane Review also noted that “Mid-urethral sling (MUS) operations are a recognized minimally invasive surgical procedure for SUI,” and that “Mid-urethral sling operations have been the most extensively researched surgical treatment for stress urinary incontinence (SUI) in women and have a good safety profile.” The review also noted: “Irrespective of the routes traversed, they are highly effective in the short and medium term, and accruing evidence demonstrates their effectiveness in the long term. This review illustrates their positive impact on improving the quality of life of women with SUI.”

Similar to the FDA’s 2011 assessment of the literature on midurethral slings, the 2015 Cochrane Review found that “overall reported rates of tape-related complications are low, such

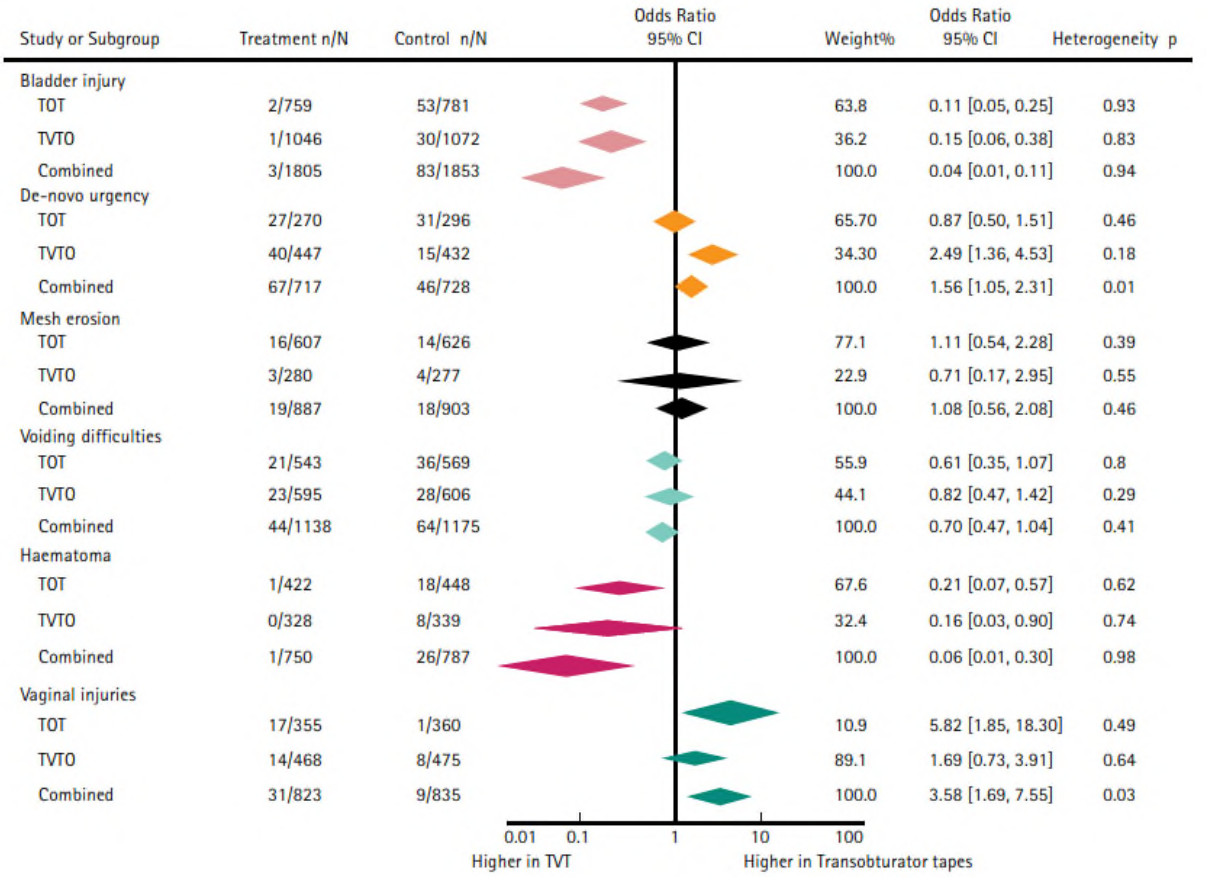
as erosion of the tape into the vagina at about 2% for both routes of tape insertion," and "the reported occurrence of problems with sexual intercourse including pain was low, and leakage of urine during intercourse improved following insertion of these tapes."

The 2015 Tommaselli meta-analysis found that retropubic midurethral slings had similar objective cure rates but higher subjective cure rates than transobutrator midurethral slings. The authors found that "overall, vaginal erosions were not different between RP-MUS and TO-MUS, being 2.1 and 2.7%, respectively." In RCTs, vaginal erosions were less frequent for retropubic midurethral slings than transobturator slings, while no differences were observed between TOT and TVT-O or between TO-MUS and minimally invasive slings." "Defining as persistent pain all pain reported beyond the perioperative period (>7 days after procedure), no differences were observed between RP-MUS and TO-MUS (2.2 % vs. 1.9 %)."

A 2009 meta-analysis[28] comparing outside-in to inside-out (TVT-O) transobturator tapes suggested equivalent objective and subjective cure rates. The authors concluded that there was equivalent effectiveness of TOT and TVT-O when compared with each other. They also found that bladder injuries and voiding difficulties seem to be less with inside-out TVT-O.

[28] Latthe, Two routes of transobturator tape procedure in stress urinary incontinence: a meta-analysis with direct and indirect comparison of randomized trials. BJUI 2009.

FIG. 4. A meta-analysis of complications with TOTs.



TVT has not only been studied in a variety of patients with diverse ages, BMIs, ethnic backgrounds, and severity of incontinence, but TVT has also been studied extensively in hundreds of clinical trials, RCTs, registries – many of those reporting long-term follow-up. It's important to note that TVT has been studied more than the Burch or Autologous Fascial Slings. The data on TVT is more robust than any other device or procedure to treat stress urinary incontinence. The long-term data shows that TVT offers a durable and safe repair over the long term. In looking at some of the TVT studies with more than 10 years of follow-up, the objective cured/improved and subjective cured/improved rates show: Nilsson 17 years 91.3% & 87.2%; Song 13 years 82.5% % 67.5%; Olsson 11.5 years 84% & 95%; Svenningsen 10.75 years 89.9% & 94.1%; Serati 10 years 93.1% & 93.1%; Heinonen 10.5 years 90% & 78%; and Aigmueller 10 years 92.5% & 80%.

TVT RCTs	**Recommend to a Friend**
Ward (2004)	84% of TVT patients would recommend the procedure to a relative or friend, compared to 82% of Burch colposuspension patients.
Valpas (2004)	The number of patients that stated the procedure entirely met expectations was 82.9% in the TVT group and 58.8% in the Laparoscopic Colposuspension group (p=0.001). The number of patients that would recommend the procedure to a friend was 92.9% of patients in the TVT group and 74.5% of patients in the Laparoscopic Colposuspension group (p=0.001).
Lee (2007)	90% of TVT patients would recommend the procedure to other patients.
Rinne (2008)	97% in the TVT group would recommend the operation to a friend.
Palva (2010)	98.4% would recommend the procedure to a friend.
Laurikainen (2011)	96% of patients would definitely recommend the operation to a friend.
Wai (2013)	94.3% would have the surgery again; 95.4% would recommend the procedure.
Khan (2014)	83.6% of TVT patients would recommend the procedure to a family member or friend, and 75.7% of Autologous fascial sling patients would recommend the procedure to a family member or friend.
Ross (2014)	97% of TVT patients would recommend the procedure to someone else with similar symptoms.
TVT Clinical Studies	**Recommend to a Friend**
Nilsson (2013) - 17 year follow-up	98% of TVT patients would recommend the procedure to a friend.
Laurikainen (2014) - 5 year follow-up	92.6% of TVT patients would recommend the procedure to a friend; only 0.7% would not.
Niemczyk (2001) - 2 month follow-up	91% of patients would recommend the procedure to their friends.

Table 3 – Patient satisfaction with the tension-free vaginal tape and the transobturator tension-free vaginal tape operations 5 yr postoperatively

	TVT		TVT-O		
Expectations met:					
Completely	84.6%	115/136	85.6%	113/132	NS
Partly	9.6%	13/136	6.1%	8/132	NS
Not at all	2.2%	3/136	0.8%	1/132	NS
Lost to follow-up	3.7%	5/136	6.8%	9/132	NS
Recommend to a friend:					
Yes	92.6%	126/136	88.6%	117/132	NS
Probably	2.9%	4/136	2.3%	3/132	NS
No	0.7%	1/136	1.5%	2/132	NS
Lost to follow-up	3.7%	5/136	6.8%	9/132	NS

TVT = tension-free vaginal tape; TVT-O = transobturator tension-free vaginal tape.

The Urinary Incontinence Treatment Network[29] also published the patient satisfaction rates from the TOMUS trial showing high success rates with TVT and TVT-O.

[29] Wai (2013): Patient Satisfaction After Midurethral Sling Surgery for Stress Urinary Incontinence

Table 1. Individual Satisfaction at 12 Months by Treatment Assignment

	Retropubic n=264	Transobturator n=263	P*
Urine leakage			
Completely dissatisfied	12 (4.6)	9 (3.5)	.52
Mostly dissatisfied	16 (6.1)	11 (4.2)	
Neutral	9 (3.4)	6 (2.3)	
Mostly satisfied	51 (19.5)	63 (24.1)	
Completely satisfied	174 (66.4)	172 (65.9)	
Urgency to urinate or fear of not making it to bathroom in time			
Completely dissatisfied	12 (4.9)	7 (2.8)	.20
Mostly dissatisfied	16 (6.6)	11 (4.4)	
Neutral	19 (7.8)	21 (8.4)	
Mostly satisfied	78 (32.0)	66 (26.3)	
Completely satisfied	119 (48.8)	146 (58.2)	
Frequent urination			
Completely dissatisfied	11 (4.5)	9 (3.8)	.46
Mostly dissatisfied	11 (4.5)	8 (3.4)	
Neutral	33 (13.4)	21 (8.8)	
Mostly satisfied	63 (25.6)	70 (29.3)	
Completely satisfied	128 (52.0)	131 (54.8)	
Physical activities			
Completely dissatisfied	10 (3.9)	8 (3.1)	.90
Mostly dissatisfied	16 (6.2)	12 (4.6)	
Neutral	6 (2.3)	7 (2.7)	
Mostly satisfied	42 (16.2)	46 (17.6)	
Completely satisfied	186 (71.5)	189 (72.1)	
Social activities			
Completely dissatisfied	10 (3.9)	12 (4.7)	.49
Mostly dissatisfied	9 (3.5)	4 (1.6)	
Neutral	10 (3.9)	6 (2.3)	
Mostly satisfied	26 (10.1)	30 (11.7)	
Completely satisfied	202 (78.6)	205 (79.8)	
Sexual activity			
Completely dissatisfied	8 (4.2)	8 (4.3)	.91
Mostly dissatisfied	4 (2.1)	3 (1.6)	
Neutral	12 (6.3)	14 (7.6)	
Mostly satisfied	22 (11.5)	26 (14.1)	
Completely satisfied	146 (76.0)	134 (72.4)	
Emotions			
Completely dissatisfied	9 (3.4)	12 (4.7)	.17
Mostly dissatisfied	18 (6.9)	7 (2.8)	
Neutral	10 (3.8)	7 (2.8)	
Mostly satisfied	28 (10.7)	35 (13.8)	
Completely satisfied	197 (75.2)	193 (76.0)	
Would you still have the surgery?			
Yes	249 (94.3)	252 (95.8)	.43
No	15 (5.7)	11 (4.2)	
Would you recommend this surgery?			
Yes	251 (95.4)	254 (96.6)	.50
No	12 (4.6)	9 (3.4)	

Data are frequency (%) unless otherwise specified.
* χ^2 comparison between retropubic and transobturator.

Table 2. Satisfaction Summary Scores for Each Domain and Composite of All Domains at 12 Months Postsurgery

Satisfaction Domain	Retropubic	Transobturator	P*
Symptom			
Dissatisfied	9 (3.4)	4 (1.5)	.26
Satisfied	255 (96.6)	259 (98.5)	
Activity			
Dissatisfied	9 (3.5)	8 (3.0)	.81
Satisfied	251 (96.5)	255 (97.0)	
Emotion			
Dissatisfied	37 (14.1)	26 (10.2)	.18
Satisfied	255 (85.9)	228 (89.8)	
Composite summary			
Dissatisfied	49 (18.6)	41 (15.6)	.42
Satisfied	215 (81.4)	222 (84.4)	

Data are frequency (%) unless otherwise specified.
* χ^2 comparison between retropubic and transobturator.

These high patient satisfaction rates following TVT and other midurethral slings have been replicated in countless studies, RCTs, and long-term data. For example, Maldonado[30] found that "patient satisfaction for both transobturator and retropubic MUSs at 2 years is high with rates up to 88%." The authors also noted, "Since the introduction of the tension-free vaginal tape in 1996, midurethral slings (MUSs) have become increasingly common, effectively replacing the Burch retropubic urethropexy as the 'gold standard' for the treatment of stress urinary incontinence."

TVT and TVT-O Midurethral Slings are the gold standard:

Fong, Nitti (2010)[31] found that: "Mid-urethral synthetic slings have grown in acceptance and popularity to gain a foremost position in stress urinary incontinence surgery. There are numerous studies that provide a large amount of level 1 and 2 evidence that support the concept of a sling placed at the level of the mid-urethra." The authors noted that midurethral slings have become the "new gold standard for the surgical treatment of female SUI, not only because of their simplicity for both the surgeon and the patient, but also because of very positive surgical outcomes and low morbidity." They confirmed that "based on the data, we

[30] Maldonado (2014): Patient satisfaction following midurethral sling surgeries.
[31] Fong (2010): Mid-urethral synthetic slings for female stress urinary incontinence.

think that it can now be said for the index patient (and perhaps some others as well), that the MUSS is the gold standard for the treatment of SUI." Midurethral slings have transformed anti-UI surgery for patient morbidity, durable care and ease of performance. Some examples of TVT/TVT-O or synthetic midurethral slings being considered the gold standard, first-line, surgical treatment for stress urinary incontinence include the following references:

TVT Literature References	**Quotes referencing TVT/MUS as surgical option of choice for SUI**
Kavvadias T, Klinge U, Schuessler B. Ch. 56 Alloplastic Implants for the Treatment of Stress Urinary Incontinence in *Hernia Repair Sequelae*, editors V. Schumpelick, RJ Fitzgibbons, Springer-Verlag publ, 2010, pp. 439-444	"At present, the gold standard in SUI surgery is the suburethral sling, using either the tension-free vaginal tape (TVT) or the transobturator tape (TOT) technique."
Cox A, Herschorn S, Lee L. Surgical management of female SUI: Is there a gold standard? Nat Rev Urol 2013;10:78-89	"Based on the literature a new gold standard first-line surgical treatment for women with SUI is the synthetic midurethral sling inserted through either a retropubic or transobturator approach."
Nilsson CG, Palva K, Aarnio R, Morcos E, Falconer C. Seventeen years' follow-up of the tension-free vaginal tape procedure for female stress urinary incontinence. Int Urogynecol J. 2013 Aug;24(8):1265-9	"The minimally invasive tension-free vaginal tape (TVT) operation has become the "gold standard" of incontinence surgery."
Serati M, Bauer R, Cornu JN, et al. TVT-O for the treatment of pure urodynamic stress incontinence: Efficacy, adverse effects, and prognostic factors at 5-year follow-up. Eur Urol 2013:63:872-878	"Retropubic and transobturator tension-free midurethral slings represent the most effective and popular procedures for the surgical treatment of stress urinary incontinence (SUI) and they are currently considered the gold standard."
Vervest HAM, Bisseling TM, Heintz PM, Schraffordt Koops SE. The prevalence of voiding difficulty after TVT, its impact on quality of life, and related risk factors. Int Urogynecol J 2007;18:173-182	"Until 1995, the "gold standard" for surgery for stress urinary incontinence (SUI) was the Burch colposuspension which resulted in good long-term outcome. This procedure has been replaced by the tension-free vaginal tape (TVT) procedure because TVT results in the same long-term outcome and has less side effects and a much lower surgical impact on quality of life of women compared to the Burch colposuspension."

Bemelmans BLH, Chapple CR. Are slings now the gold standard treatment for the management of female urinary stress incontinence and if so which technique? Curr Opin Urol 2003;13:301-307	"Sling surgery for the treatment of female stress urinary incontinence has become so popular as a consequence of excellent results that possibly the time has come to consider this type of surgery as the new gold standard." "Tension-free vaginal tape (TVT) has become the most commonly used technique in the world in no more than 5 years. It seems to have replaced other established therapies and therefore must be considered a new reference point." "TVT has become popular amongst both patients and doctors alike, mainly because of the initially reported advantages of safety, effectiveness and its minimally invasive nature. The perception has been that for the first time in history SUI can be cured with a simple, safe and worldwide standardized technique."
Serati M, Salvatore S, Uccella S, et al. Surgical treatment for female stress incontinence: What is the gold-standard procedure? Int Urogynecol J 2009;20:619-621	"Recently, a number of meta-analysis have demonstrated that TVT is significantly more effective if compared to colposuspension and that it is followed by significantly lower perioperative morbidity if compared to pubovaginal slings. It is not realistic to suggest to general practitioners that the surgical gold standard for SUI includes the performance of a wide laparotomy, long hospital stays and a high risk of long-lasting intermittent self-catheterisation. This would inevitably discourage women from embarking on surgical treatment, which instead could actually improve their quality of life." "Considering the RCTs comparing TVT to Burch colposuspension, complication rates were similar after the two procedure[s], with the exclusion of bladder perforation, which was more common after TVT (p=0.0001), and reoperation rate, which was significantly higher after Burch colposuspension (p=0.02)."
Constantini E, Lazzeri M, Kocjancic E, et al. ICS Abs 3 Prolonged follow-up shows continence deterioration after transobturator tape: Results from a randomised controlled trial. International Continence Society Mtg 2013	"Retropubic and transobturator Tension-Free Midurethral Slings (TVT, TOT), the most effective and popular surgical procedures for stress urinary incontinence (SUI), are currently considered the gold standard."

Elena Cattoni, Serati M, Braga A, et al. ISU Abs 5 Can preoperative overactive bladder (OAB) symptoms influence TVT-O outcome? Neurolurol and Urodyn; International Society of Urology Conference abstracts 2012	"Midurethral slings, such as the tension-free vaginal tape (TVT) and the transobturator midurethral slings (TVT-O) are safe and effective surgical procedures that quickly became the gold standard for urodynamic stress incontinence (USI) surgery."
Zhong C, Yuan C, Guang-hui D, et al. Comparison of three kinds of mid-urethral slings for surgical treatment of female stress urinary incontinence. Urologia 2010;77(1):37-42	"The tension-free vaginal tape procedure (TVT) has been used in the treatment of female SUI since 1995 and it is now considered by many surgeons to be the gold standard for surgical correction of female SUI." "Numerous reports have shown that the cure rate for TVT ranges between 80% and 90% in multiple patient groups during follow-up periods of more than 3 years."
Tommaselli GA, D'Afiero A, Di Carlo C, et al. ICS Abs 791 Single incision tension-free vaginal tape (TVT-Secur®) in the treatment of female stress urinary incontinence. International Continence Society Mtg 2010	"TVT procedures (both retropubic and transobturator) have become the gold standard in the treatment of female stress urinary incontinence (SUI)."
Moore RD, Miklos JR. IUGA Abs 298 Single incision mini-sling. 1 year follow-up on a new minimally invasive treatment for female SUI. Int Urogyn J 2009;20(Suppl 3):S312-313	"The mid-urethral tension-free vaginal tape sling has emerged as the gold standard to treat female stress urinary incontinence (SUI)."
Moore R, Mitchell G, Miklos J. ICS Abs 827 MiniArc single incision sling: 1 year follow-up on a new minimally invasive treatment for female SUI. International Continence Society Mtg 2009	"The mid-urethral tension-free vaginal tape sling has emerged as the gold standard to treat female stress urinary incontinence (SUI)."
Di Piazza L, Piroli Torelli D, Polichetti M, et al. IUGA Abs. 430 Complications in short suburethral sling positioning. Int Urogyn J 2009;20(Suppl 3):S403-404	"TVT and TOT represent the gold standard for SUI surgical treatment."
Polichetti M, Piroli Torelli D, Di Piazza D, et al. IUGA Abs. 557 SUS (suburethral support): a new technique for short suburethral sling application. Int Urogyn J 2009;20(Suppl 3):S477-478	"Nowadays TVT and TOT represent the gold standard for correction of SUI, showing a success rate up to 80-90%." "Development of fibrous reaction surrounding the sling allows its adhesion to adjacent structures, this being the mechanism of suspension utilized in tension-free techniques."

Renganathan A, Basu M, Duckett J. A series of Advantage suburethral slings. J Obstet Gynaecol Aug 2011;31:521-523	"Minimally invasive surgical procedures have largely replaced the Burch colposuspension in the last 2 decades, since the introduction of the integral theory (Petros and Ulmsten 1993). Midurethral slings made of synthetic materials remain the popular option for surgical treatment of SUI. Long-term effectiveness and safety of the tension free vaginal tape at 11-year follow-up was excellent with 90% objective and 77% subjective cure rates (Nilsson 2008)."
Parden AM, Gleason JL, Jauk V, et al. Incontinence outcomes in women undergoing primary and repeat midurethral sling procedures. Ob Gyn 2013 Feb;121(201):273-278	"SUI can be treated with both non-surgical and surgical treatments, but the only documented long term curative treatment is surgery. The most common surgical treatment performed in the United States is the midurethral sling." "A midurethral sling is now considered the gold standard for SUI treatment with over 103,000 performed annually. Success rates of these procedures at 12 months range from 77-90% reflecting differences in definition of success."
Barber MD. Cleveland Clinic leads multicenter trial of single-incision 'mini-sling' for stress urinary incontinence. Ob/GYN & Women's Health Research Perspectives. Summer 2011. clevelandclinic.org/obgyn	"More than 200,000 surgical procedures are performed in the U.S. each year for stress urinary incontinence. Midurethral slings like the tension-free vaginal tape (TVT) are quick, safe and effective outpatient procedures for stress incontinence that are considered by many to be the "gold standard" treatment for this condition."
Wai CY. Surgical treatment for stress and urge urinary incontinence. Obstet Gynecol Clin N Amer 2009;36:509-519	"The introduction of minimally invasive slings has revolutionized the way we approach surgery for urinary incontinence and has challenged our view of the Burch colposuspension as the gold standard surgical procedure for stress urinary incontinence."
Calvo JJ, Alfara AH, Cebrian Lostal JL, et al. Stress urinary incontinence surgery with MiniArc sling system: Our experience. Actas Urologicas Espanolas 2010;34(4):372-377	"The first generation of suburethral tapes was the retropubic TVT; its long-term efficacy has been proved with follow-up studies longer than 7 years; in fact, TVT is today's gold standard for surgery for SUI."
DeSouza R, Shapiro A, Westney OL. Adductor brevis myosistis following transobturator tape procedure: a case report and review of the literature. Int Urogyn J 2007;18:817-820	"The tension-free vaginal tape (TVT) procedure has long been considered the gold standard for female stress incontinence."
Phillips L, Flood CG, Schulz JA. Case report of tension-free vaginal tape-associated bowel obstruction and relationship to body habitus.	"Tension-free vaginal tape (TVT) is increasingly being used as the gold standard to treat stress urinary incontinence."

Int Urogyn J 2009;20:367-368	
Hinoul P, Roovers JP, Ombelet W, et al. Surgical management of urinary stress incontinence in women: A historical and clinical overview. Eur J Obstet Gyn Reprod Biol 2009;145:219-225	"Colposuspension, as the gold standard, seemed to be replaceable by a standardized, non-obstructive tape suspension that could be performed under local anesthesia. With reported continence rates as high as 81% after 91 months and randomized controlled trial data demonstrating equal effectiveness, it is no surprise that the mid-urethral sling is becoming the preferred management option for the treatment of urodynamic stress incontinence."
Labrie J, van der Graaf Y, Buskens E, et al. Protocol for physiotherapy OR TVT Randomised efficacy trial (PORTRET): a multicenter randomized controlled trial to assess the cost-effectiveness of the tension free vaginal tape versus pelvic floor muscle training in women with symptomatic moderate to severe stress urinary incontinence. BMC Women's Health 2009;9:24-32	"In the past decade, surgery for stress incontinence has made a huge progression with the introduction of minimally invasive surgical techniques. The Tension-free Vaginal Tape (TVT) and Tension-free Vaginal Tape Obturator (TVT-O) are the most frequently performed procedures."
Rechberger T, Wrobel A, Adamiak A, Skomra D, et al. The tissue reaction to polypropylene mono-et multifilamentous tape used in surgical techniques of stress urinary incontinence treatment. Gin Pol 2003;74(9):1008-1013	"The "gold standard" in surgical treatment of stress urinary incontinence (SUI) is sling operations with polypropylene tape appliance under midurethra. There are two types of polypropylene tape which are the most popular nowadays."
Abdel-Fattah M, Ramsay I, Pringle S, et al. Randomised prospective single-blinded study comparing 'inside-out' versus 'outside-in' transobturator tapes in the management of urodynamic stress incontinence: 1-year outcomes from the E-TOT study. BJOG 2010;117:87-878	"Midurethral tension-free vaginal tape has been the mainstay in the treatment of female urodynamic stress incontinence (USI) over the last decade. It is well established that the advent of tension-free tape (TVT; Ethicon Inc., Somerville, NJ, USA) has revolutionized anti-incontinence surgery, with an emphasis on mesh/tape reinforcement at the midurethral level, creating a 'hammock that supports the urethral closure mechanism at times of increased intra-abdominal pressure."
Serati M, Ghezzi F, Cattoni E, et al. Tension-free vaginal tape for the treatment of urodynamic stress incontinence: Efficacy and adverse effects at 10-year follow-up. Eur Urol 2012;61:939-946	"The long-term results of this prospective observational study seem to demonstrate that the TVT is a highly effective option for the treatment of female SUI. Indeed, we recorded very high cure rates and low complication rates over the 10-year observation."

Lee EW, Nitti VW, Brucker BM. Midurethral slings for all stress incontinence. A Urology Perspective. Urol Clin N Amer 2012;39:299-310	"The midurethral sling (MUS) is the gold standard for stress urinary incontinence (SUI) in the index patient, with equivalent outcomes and minimal adverse events in comparison with traditional SUI procedures." "With appropriate patient counseling, the MUS can be considered first-line therapy for more complicated situations as well." "The midurethral sling (MUS) is now the most commonly performed surgical treatment for stress urinary incontinence (SUI). It is considered the gold standard for patients with genuine SUI."
Abdel-Fattah M, Ramsay I, Pringle S, et al. Randomised prospective single-blinded study comparing 'inside-out' versus 'outside-in' transobturator tapes in the management of urodynamic stress incontinence: 1-year outcomes from the E-TOT study. BJOG 2010;117:87-878	"Midurethral tension-free vaginal tape has been the mainstay in the treatment of female urodynamic stress incontinence (USI) over the last decade. It is well established that the advent of tension-free tape (TVT; Ethicon Inc., Somerville, NJ, USA) has revolutionized anti-incontinence surgery, with an emphasis on mesh/tape reinforcement at the midurethral level, creating a 'hammock that supports the urethral closure mechanism at times of increased intra-abdominal pressure."
Pradhan A, Jain P, Latthe PM. Effectiveness of midurethral slings in recurrent stress urinary incontinence: a systematic review and meta-analysis. Int Urogyn J 2012;23:831-841	"The studies report good cure rates for SUI after MUS surgery following previous incontinence surgery (62 - 100%). "Midurethral slings (MUS) are the primary gold standard procedure for treating SUI with long-term cure rates of 77-90%."
Nilsson CG, Kuuva N, Falconer C, et al. Long-term results of the tension-free vaginal tape (TVT) procedure for surgical treatment of female stress urinary incontinence. Int Urogyn J 2001;Suppl 2:S5-S8	"In light of these good long-term results the TVT operation can be recommended as a routine surgical procedure for effective treatment of female stress incontinence."
Debodinance P, Delporte P, Engrand JB, Boulogne M. Tension-free vaginal tape (TVT) in the treatment of urinary stress incontinence: 3 years' experience involving 256 operations. Eur J Obstet Gynecol Reproduct Biol 2002;105:49-58	"This minimally invasive operation should be further assessed so that it can demonstrate its effectiveness, and become the "Gold standard"." "The highly encouraging results and the low invasiveness of this operation led us to start using TVT from 1998, and we are reporting this experience here."

Dean N, Herbison P, Ellis G, Wilson D. Laparoscopic colposuspension and tension-free vaginal tape: a systematic review. BJOG 2006;113:1345-1353	"The evidence so far appears to be in favour of the TVT as the minimal-access technique of choice for USI in comparison with laparoscopic colposuspension; however, long-term data are still needed."
Chene G, Amblard J, Tardieu AS, et al. Long-term results of tension-free vaginal tape (TVT) for the treatment of female urinary stress incontinence. Eur J Obstet Gyn Reproduct Biol 2007;134:87-94	"Treatment of urinary incontinence by TVT is a reliable, mini-invasive reproducible technique, almost suitable for outpatients, with no serious complications; it is inexpensive and very successful, including in complicated cases such as sphincter deficiency. All the recent data confirms, with this 5-year follow-up, that the TVT procedure is comparable to the previously gold standard, the Burch colposuspension."
Karram M, Zoorob D. When and how to place an Autologous rectus fascia pubovaginal sling. OB Management 2012 Nov;24(11):24-33	"Although synthetic midurethral slings remain the standard of care for most women with stress urinary incontinence, an autologous graft is a safe and effective alternative."
Nager CW. Synthetic full-length midurethral slings remain the standard of care for SUI surgery. OB Management 2012 Nov;24(11):6-7	"Synthetic full-length midurethral slings remain the standard of care for SUI surgery." "The first retropubic MUS was the tension-free vaginal tape (TVT) procedure published by Ulmsten in 1996. This minimally invasive out-patient procedure using a 1-cm wide strip of polypropylene mesh has revolutionized the management of SUI and has been the most studied surgical procedure in all of gynecology. A PubMed search of "tension-free vaginal tape" reveals more than 2,000 publications."

RCTs show high objective and subjective cure and low complications with TVT and TVT-O.

- Pifarotti (2001)[32] reported 100% objective cure with TVT and 65% objective cure with endopelvic fascia plication.at 8.8 months follow-up.

- Liapis (2002)[33] reported significantly more patients in the Burch colposuspension group reported higher pain scores (78%) and required "stronger" analgesics (86%) compared to no patients in the TVT group ($p<0.001$ for both comparisons). Further, Liapis

[32] Pifarotti (2001): A randomized prospective comparison of TVT and endopelvic fascia plication in the treatment of occult stress urinary incontinence in patients with genital prolapse: preliminary data
[33] Liapis (2002): Burch colposuspension and tension-free vaginal tape in the management of stress urinary incontinence in women.

concluded that "TVT and Burch colposuspension are equally effective in the management of female GSI at two years follow-up. TVT procedure requires much less operative time, has much shorter hospitalization time, with significantly less postoperative pain and faster return to normal daily activities than Burch colposuspension."

- Adile (2003)[34] found objective cure rates of 94% in the TVT group and 91% in the laparoscopic Burch group. The authors reported the mean hospital cost of TVT is lower than the one of laparoscopic Burch, and the learning curve for surgeons is longer with laparoscopic Burch.

- Ulstun (2003)[35] reported similar objective and subjective cure rates of 82.6% for TVT and laparoscopic Burch, but found several advantages with TVT over laparoscopic Burch. None of the TVT patients had urethral or vaginal erosion, defect healing, or tape resection.

- Wang (2003)[36] reported that a properly performed TVT procedure does not cause urethral obstruction. The authors found similar objective and subjective cure rates of 82% and 92% for TVT and 76% and 93% for Burch colposuspension. There were no significant complications caused by either procedure.

- Kondo (2003)[37] concluded that the tension-free vaginal tape is promising because of less surgical invasiveness, less postoperative complications and objective cure at 2 years being comparable with pubovaginal sling, finding 68.4% objective cure for TVT vs. 45.7% objective cure for pubovaginal sling, and 85.9% subjective cure for TVT vs. 71.8% subjective cure for pubovaginal sling.

[34] Adile (2003): A prospective randomized study comparing laparoscopic Burch versus TVT. Short and long term follow-up.
[35] Ulstun (2003): Tension-free vaginal tape compared with laparoscopic Burch urethropexy.[Erratum appears in J Am Assoc Gynecol Laparosc. 2003 Nov;10(4):581].
[36] Wang (2003): Comparison of tension-free vaginal taping versus modified Burch colposuspension on urethral obstruction: a randomized controlled trial.
[37] Kondo (2003): A randomised control trial of tension-free vaginal tape in comparison with pubovaginal sling in the treatment of stress incontinence

- Meschia (2004)[38] reported objective cure of 92% for TVT vs. 56% for endopelvic fascia plication and subjective cure of 96% for TVT vs. 64% for fascia plication.

- Paraiso (2004)[39] concluded that the TVT procedure results in greater objective and subjective cure rates for urodynamic stress incontinence than does laparoscopic Burch colposuspension. TVT showed 96.7% objective cure vs. 81.2% for laparoscopic Burch. Multiple outcome measures were analyzed, which confirmed the superior efficacy of the TVT procedure.

- Valpas (2004)[40] concluded that treatment with TVT results in higher objective and subjective cure rates at 1 year than treatment by means of laparoscopic mesh colposuspension. The number of patients that stated that the procedure entirely met expectations was 82.9% in the TVT group and 58.8% in the LC group (p=0.001). The number of patients that would recommend the procedure to a friend was 92.9% of patients in the TVT group and 74.5% of patients in the LC group (p=0.001).

- The Ward, Hilton RCT study[41] which started in 1998 aimed at evaluating the TVT vs. Burch found that at six months the TVT procedure is as effective as the Burch for the primary treatment of stress incontinence; that operative complications were more common with vaginal tape, but duration of hospital stay and return to normal activity were shorter with TVT than Burch; and that post-operative complications were more common after Burch colposuspension. Prior to the introduction of the TVT, colposuspension was the most common procedure for primary surgery. Long-term follow-up studies have reported cure rates for colposuspension ranging from 63 to 81% with 5- to 20-year follow up.[42] The authors also noted that complications of Burch

[38] Meschia (2004): A randomized comparison of tension-free vaginal tape and endopelvic fascia plication in women with genital prolapse and occult stress urinary incontinence.
[39] Paraiso (2004): Laparoscopic Burch colposuspension versus tension-free vaginal tape: a randomized trial.
[40] Valpas (2004): Tension-free vaginal tape and laparoscopic mesh colposuspension for stress urinary incontinence.
[41] Ward (2002): Prospective multicentre randomised trial of tension-free vaginal tape and colposuspension as primary treatment for stress incontinence
[42] References 5-10: Kinn AC. Burch colposuspension for stress urinary incontinence. 5-year results in 153 women. Scand J Urol Nephrol 1995;29:449–55; Kjolhede P, Ryden G. Prognostic factors and long-term results of the Burch colposuspension. A retrospective study. Acta Obstet Gynecol Scand 1994;73:642–7; van Geelen JM, Theeuwes AG, Eskes TK, Martin CB Jr. The clinical and urodynamic effects of anterior vaginal repair and Burch colposuspension.

colposuspension include haemorrhage, haematoma, bladder injury, and urinary tract infection. Up to 20% of women may develop de novo detrusor overactivity; voiding dysfunction has been reported in 3% to 32% of women, and surgery for vaginal prolapse may be required in 2.5% to 26.7% after the procedure. The authors published five year follow-up data showing similar success rates. They concluded that "the effect of both procedures on cure of incontinence and improvement in quality of life and sexual health is maintained in the long term." At five years, 3.4% of the Burch patients required additional surgery for stress urinary incontinence, with 3 patients receiving a TVT after the failed Burch procedure, while 2.3% of the TVT patients required another treatment. There were a total of 6 tape-related complications, which included mesh erosion, exposure, and one patient with obstructed voiding that required tape division. Sexual function and lifestyle improved in both groups. There were two true vaginal erosions (only one of which was symptomatic) in the 72 women examined at 5 years. Overall, 91% of the women who had undergone TVT and 90% who had undergone colposuspension regarded themselves as satisfied or very satisfied with the results of their surgery at 5 years.

Symptom	TVT		Colposuspension	
	Before surgery (*n* =168)	5 years (*n* =98)	Before surgery (*n* =155)	5 years (*n* =79)
Sexual questions				
Pain due to dry vagina	34 (31)	28 (19)	39 (32)	32 (22)
Sex life spoilt by urinary symptoms**	72 (68)	18 (14)	62 (58)	15 (11)
Pain with intercourse	35 (34)	15 (13)	32 (25)	22 (19)
Incontinence with intercourse**	60 (56)	6 (4)	62 (53)	9 (8)
Lifestyle questions				
Fluid restriction**	72 (57)	39 (16)	71 (49)	32 (18)
Ability to perform daily tasks**	81 (74)	14 (10)	81 (78)	14 (11)
Avoiding places/situations**	73 (68)	37 (27)	73 (69)	28 (18)
Interfering with physical activity**	95 (93)	18 (17)	93 (90)	18 (14)
Interfering with social relationships**	72 (70)	13 (12)	76 (74)	14 (10)
Interfering with life overall**	98 (not applicable)	31 (not applicable)	94 (not applicable)	24 (not applicable)

Am J Obstet Gynecol 1988;159:137–44; Feyereisl J, Dreher E, Haenggi W, Zikmund J, Schneider H. Long-term
results after Burch colposuspension. Am J Obstet Gynecol 1994;171: 647–52; Eriksen BC, Hagen B, Eik-Nes SH, Molne K, Mjolnerod OK, Romslo I. Long-term effectiveness of the Burch colposuspension in female urinary stress incontinence. Acta Obstet Gynecol Scand 1990;69: 45–50; Alcalay M, Monga A, Stanton SL. Burch colposuspension: a 10-20 year follow up. Br J Obstet Gynaecol 1995;102:740–5.

The investigators, which included the following group participating in the 5-year extension: Paul Abrams (Southmead Hospital, Bristol), Jonathan Bibby (Northampton General Hospital), Linda Cardozo (King's College Hospital, London), Malcolm Frazer and Ezzat Kozman (Warrington Hospital), P.H. and K.L.W. (Royal Victoria Infirmary, Newcastle upon Tyne), David Holmes (St Paul's Hospital, Cheltenham), Mohsen Iskander (Southport General Hospital), Declan Keane (National Maternity Hospital, Dublin), Ash Monga (Princess Anne Hospital, Southampton), David Richmond (Liverpool Women's Hospital) and David Sanderson (Colchester General Hospital). The authors noted that they "had complete freedom to analyze the data and report the results as they saw fit."

- Colombo (2005)[43] reported patients with potential stress incontinence (P=.051) and clinical stress incontinence (P=.004) cure rate was 79% and 31% for the Pereyra bladder neck suspension group, respectively vs. 95% and 100% in the TVT group, respectively.

- El-Barky (2005)[44] reported the success rates of TVT and Burch colposuspension in the treatment of SUI are very similar. However, TVT is associated with less morbidity. It was recommend that TVT procedure for females with genuine SUI. Cure rates were 92% for TVT and 88% for Burch at 2 year follow-up.

- Mirosh (2005)[45] found that TVT requires less operative time and has a shorter hospital stay compared to Laparoscopic Burch. The complications rates are comparable and patients are equally satisfied with either procedure. The improvements in quality of life scores at one year post surgery are similar.

- Kondo (2006)[46] concluded that the TVT was significantly superior to the pubovaginal sling in terms of operation time, postoperative pain, and hospital charges, but not in cure rates. A longer follow up with a larger sample size is necessary to draw definite

[43] Colombo (2005): Randomized study to compare pereyra and TVT procedures for women with stress urinary incontinence and advanced urogenital prolapse.
[44] El-Barky (2005): Tension free vaginal tape versus Burch colposuspension for treatment of female stress urinary incontinence.
[45] Mirosh (2005): TVT vs laparoscopic Burch colposuspension for the treatment of stress urinary incontinence.
[46] Kondo (2006): Efficacy, safety and hospital costs of tension-free vaginal tape and pubovaginal sling in the surgical treatment of stress incontinence.

conclusions. The objective cure rate for the TVT group was 70.3% compared to 48.3% in the PVS group (p=0.056). The subjective cure rate for the TVT group was 83.3% compared to 64.5% in the PVS group (p=0.101).

- Amaro (2007)[47] concluded that surgery time was shorter and Pad Test results better for TVT patients compared to patients who received an Autologous fascial sling. Subjective and objective evaluations were similar between groups at 12 months. TVT cure rates were 75% at 1 month, 70% at 6 months, and 65% at 12 months. Autologous fascial sling cure rates were 71% at 1 month; 57% at 6 months, and 57% at 12 months.

- Sharifiaghdas (2008)[48] found at 36 month follow-up objective cure based on the cough test occurred in 88% of TVT patients and 83% of the sling group (p=0.78). Objective cure based on the 1 hour pad test occurred in 76% of TVT patients and 75% of the sling group (p=0.83). The mean IIQ score was 44.3 in the TVT group and 48.5 in the sling group (p=0.46). Fifteen (72%) of the TVT group and 20 (55%) of the sling group were satisfied with the operation (p = 0.3).

- Gamble (2010)[49] found that bladder neck and retropubic midurethral slings have similar efficacy in the treatment of women with stress urinary incontinence and low pressure urethra. Retropubic polypropylene midurethral slings, because of their technical ease and high success rates, offer favorable outcomes for most patients, including those presenting with low urethral closure pressures.

- Guerrero (2010)[50] found 12 month subjective cure rates to be 93% for TVT and 90% for Autologous fascial sling. The Autologous fascial sling length of operation took statistically significantly longer to perform. Length of stay Hospital stay was shorter for women who had TVT. The Autologous fascial sling group had a higher rate of self-catheterization.

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[47] Amaro (2007): A prospective randomized trial of Autologous fascial sling (AFS) versus tension-free vaginal tape (TVT) for treatment of stress urinary incontinence (SUI)
[48] Sharifiaghdas (2008): Tension-free vaginal tape and Autologous rectus fascia pubovaginal sling for the treatment of urinary stress incontinence: a medium-term follow-up.
[49] Gamble (2010): TVT versus bladder neck sling in the treatment of low pressure urethra.
[50] Guerrero (2010): A randomised controlled trial comparing TVT, Pelvicol and Autologous fascial slings for the treatment of stress urinary incontinence in women.

- Khan (2014)[51] found that subjective success rates of 73% for TVT and 75.4% Autologous fascial sling. Additionally, 69.3% women with TVT were satisfied with surgery and 83.6% would recommend it to a family member/friend. The satisfaction rate for Autologous fascial sling was70.1%, with 75.7% willing to recommend it to a family member/friend.

- Valpas (2014)[52] found both objective and subjective cure rates were significantly higher in the TVT group than in the laparoscopic colposuspension group at 5 year follow-up. The objective cure rate for TVT at 94% was significantly higher than the laparoscopic colposuspension group at 78%, as were the subjective cure rates at 64% and 54%, respectively.

[51] Khan (2014): Long term follow-up of a multicentre randomised controlled trial comparing TVT, Pelvicol and Autologous fascial slings for the treatment of stress urinary incontinence in women
[52] Valpas (2014): TVT versus laparoscopic mesh colposuspension: 5-year follow-up results of a randomized clinical trial

Table 2 Operative, admission, and postoperative details of women allocated tension-free vaginal tape procedure or colposuspension. Values are numbers (percentages) unless stated otherwise

	Vaginal tape group (n=170)	Colposuspension group (n=146)	P value
Median (interquartile range) theatre times (min):			
Holding bay	5 (5-10)	5 (5-12)	0.48*
Anaesthetic room	15 (10-50)	17 (14-25)	<0.001*
Operating theatre	40 (30-48)	50 (35-60)	<0.001*
Recovery area	41 (31-60)	85 (65-115)	<0.001*
Anaesthesia:			
General	3 (2)†	145 (99)	
Spinal	3 (2)‡	1 (1)	
Local and sedation	164 (96)	Not applicable	
Median (interquartile range) blood loss (ml)	50 (30-100)	128 (74-200)	<0.001*
Opiate analgesia used in first 24 hours postoperatively	35 (21)	133 (91)	<0.001§
Duration of catheterisation (suprapubic, urethral, or intermittent):			
1-7 days	64 (38)	146 (100)	
8-28 days	9 (5)	48 (33)	<0.0001§
29 days to 6 months	5 (3)	19 (13)	<0.001§
>6 months	5 (3)	11 (8)	0.0746§
Complications:			
Bladder injury (perforation or evidence of trauma)	15 (9)	3 (2)	0.013§
Vaginal perforation	5 (3)	0	0.06§
Wound infection	4 (2)	10 (7)	0.06§
Fever**	1 (1)	7 (5)	0.027§
Deep vein thrombosis	0	3 (2)	0.10§
Incisional hernia	Not applicable	3 (2)	
Retropubic haematoma	3 (2)	0	0.25§
Vascular injury¶	1 (1)	0	1.0§
Tape erosion	1 (1)	Not applicable	
Urinary tract infection (in six weeks after surgery)	38 (22)	46 (32)	0.074§
Total complications (excluding fever)**	67 (39)	65 (44.5)	0.36§
Median (interquartile range) postoperative hospital stay (days)	1 (1-2)	5 (5-7)	<0.001*
Median (interquartile range) time to return to normal activities (weeks)	3 (2-4)	6 (4-8)	<0.001*
Median (interquartile range) time to return to work (weeks)	4 (3-7)	10 (8-12)	<0.001*
Response to procedure:			
Satisfied or very satisfied	145 (85)	119 (82)	
Dissatisfied	7 (4)	4 (3)	
Would recommend to relative or friend	143 (84)	119 (82)	

TVT is the most widely studied and best studied device and procedure used in women to treat stress urinary incontinence. While Professor Ulmsten may have been paid several million dollars for his device; any bias at this point is insignificant as his findings have been repeatedly duplicated in his multi-center study, and in hundreds of other clinical studies and RCTs evaluating the success and complications of TVT. The same is true for TVT-O and any potential bias of Dr. de Leval. TVT and TVT-O have been studied by hundreds of surgeons in numerous institutions and hospitals across the world, and the vast body of literature has been consistent with Ulmsten's and de Leval's initial results, even in the long-term. Doctors and patients have described TVT and TVT-O as the gold standard, the standard of care, the first-line surgical option, and the best treatment option for stress urinary incontinence based on the standardization of the procedure and the clinical results from the hundreds of clinical studies and RCTs.

Although tiny particles may be observed in the packaging and may not be attractive, they do not represent a product defect and do not cause harm to patients. I have used both mechanically cut and laser cut TVT and I have not noticed a difference between the two, nor have I noticed any problems with particle loss in my clinical practice or in any of my patients.. Similarly, I have not had any problems with particle loss or particle loss that causes complications that is reported in the medical literature. Any theoretical Prolene particles that might break off from the body of the mesh would be much smaller than single suture knots which are regularly left in the body without harm, and they are intended to be there. There is no evidence that particles are even in the body, and no evidence that they migrate. The TVT sheath protects against stretching and particle loss. The tissue is quickly integrated into the pores of the TVT, which would prevent any particles from breaking off. The TVT mesh is not stretched within the body as it is integrated into the tissue like lattice. There is no published literature attributing any harm to particle loss from TVT. I have performed a PubMed search for "TVT" and "Particle Loss" and "Particles", and was unable to find any clinical studies describing in vivo complications that resulted from particle loss. The only study that populated from the search was Pariente's 2005 benchtop study using weights and machines to test for particle loss.

Any theory that particles from TVT somehow fall off and cause complications, such as dyspareunia, or an increase in complications, is unfounded and not based on clinical data as there is no published literature attributing any harm to particles. I have reviewed Dr. Rosenzweig's testimony from the Lewis trial about the French Pariente study, and have come to

appreciate that his opinion is that 8.5% of all TVT meshes have some particle loss. The Pariente study is not a clinical study. I am familiar with Ethicon's testing that shows around 1% particle loss under similar experimental testing conditions. Regardless, there is no clinical literature evaluating particle loss from TVT that has suggested that particle loss occurs in vivo, that particle loss has any clinically significant impact, that particle loss causes an increased inflammatory response, or that particle loss causes an increase in complications. Ethicon's 14 day rabbit study also evaluated particle loss in the muscles of the rabbit and found no particle loss or increase in inflammation due to particle loss.

Fraying of the TVT mesh does not equate to particle loss, and fraying does not cause complications or an increase in complications. I am aware that Ethicon received complaints of fraying, but I am unaware of fraying being linked to a clinical complaint. I am aware of an issue report that discusses a patient who had dyspareunia from frayed mesh, but it was most likely referring to a mesh exposure. I have had to explant mechanically cut TVT mesh on occasion and have not noticed any in vivo particle loss, fraying, roping, curling, or degradation. The edges of the mechanically cut mesh are immediately integrated into the tissue as part of the Velcro effect. Long-term studies have shown that TVT retains its construction over the long-term as success rates have not been shown to decline over time as one would suspect if there was stretching, roping, fraying, or curling that would result in women becoming incontinent.

The safety and efficacy profile of mechanically cut TVT is supported by robust long-term data with follow-up longer than 10 years, and any suggestion that TVT causes any clinically significant degradation that leads to complications or an increase in complications. I have reviewed the medical literature and have not found any published clinical studies that have confirmed degradation or a statistically significant correlation between degradation and an increase in inflammation or foreign body reaction. It should be noted that inflammation and foreign body reactions are not complications, but rather, are part of the natural wound healing process. Everything degrades over time, but Prolene is the most reliable and resistant material and it has withstood the test of time in a battery of clinical uses and tests extending out to almost 50 years. To the extent the Prolene TVT mesh does degrade, it is minimal and not clinically significant as the mesh retains its construction and causes no harm. There is no literature that suggests that TVT degrades in the body, and not one of the hundreds or even thousands of clinical studies and randomized controlled trials have found degradation or any harm that resulted from degradation. In 1990, the FDA approved the reclassification of

polypropylene sutures from Class III to Class II devices based on the extensive safety profile associated with polypropylene sutures in clinical use. The FDA concluded that clinical performance of polypropylene sutures is well established and well documented; that degradation proceeds slowly and is generally not considered clinically significant; and that polypropylene is the suture of choice in closing infected or contaminated wounds.

Record data show that nonabsorbable polypropylene surgical suture's performance parameters and uses are well documented and understood, and that the generic type of device presents a reasonably uniform risk/benefit profile. Indeed the characteristics and composition of polypropylene are well-defined (Refs. 23, 24, 57, 58, 69, 72, 90, 91, 95, 113, 117, 120, 121, 126, 128-131, 134 and 135). Moreover, the performance parameters of existing nonabsorbable polypropylene surgical suture are well established (Refs. 9, 24, 29, 45, 50, 64, 121, 133, 134, 135 and 137) and the record shows the reasonably safe and effective use of nonabsorbable polypropylene surgical suture in humans (Refs. 17, 21, 33, 41, 42, 87, 95, 120 and 138).

The loss of tensile strength leading to suture breakage is a potential cause of failure of nonabsorbable polypropylene surgical suture in certain applications (Refs. 4, 32, 42, 70, 115 and 149). Retention of the suture's tensile strength is critical to the function of nonabsorbable polypropylene surgical suture. The record data show that the loss of tensile strength in vivo is primarily related to the oxidative degradation of the polypropylene polymer (Refs. 4, 29, 32, 42, 43 and 44) and that the polymer's degradation proceeds slowly and is generally not considered clinically significant under most circumstances of use (Refs. 1, 4, 42, 121 and 149). The rate and extent of oxidative degradation vary according to exposure to ultraviolet radiation, and may make the use of the suture in the eye questionable (Refs. 4, 32, 42, 70 and 149). Oxidative enzyme activity and the type of tissue at the wound site, e.g., actively metabolizing tissues, tissues with high oxygen concentration, and inflammation may also contraindicate the suture for certain applications (Refs. 4, 32, 42, 43, 44, 70 and 149).

The appropriate use of nonabsorbable polypropylene surgical suture is important in defining its performance. The record shows that nonabsorbable polypropylene surgical suture has been successfully used in various wound sites and conditions in humans (Refs. 17, 21, 33, 41, 42, 87, 95, 120 and 138). Although, wound dehiscence is most significant in wound closures involving sites which can undergo expansion, stretching, or distention, such as the abdomen, chest, and joints, nonabsorbable polypropylene surgical suture may be the suture of choice due to its continued support of tissues (Refs. 11, 17, 18, 22, 33, 48, 66, 74, 79, 80, 81, 87, 102, 108, 121 and 137). Using nonabsorbable polypropylene surgical suture to close certain wounds has documented advantages related to the physical properties of the suture (Refs. 11, 22, 33, 66, 74, 79, 80, 81, 87, 108 and 121).

In the presence of infection or contamination, all sutures appear to potentiate the wound infection (Refs. 29, 45, 48, 50, 123 and 127). While nonabsorbable polypropylene surgical suture is not unique in its potential to exacerbate infection, it does appear to carry a somewhat lesser risk than other sutures in this regard (Refs. 16, 32, 40, 55, 95, 121, 123, 126, 138 and 170). The choice of suture material may, therefore, be critical when closing a wound in the presence of infection or potential infection. Because the nonabsorbable polypropylene surgical suture presents somewhat of a lesser risk than other sutures to potential infection, it is a suture of choice for infected wounds or contaminated wounds that present a substantial risk of infection (Refs. 16, 29, 32, 35, 40, 45, 48, 55, 73, 95, 123, 126, 138, 139, 140 and 141).

In summary, since suture selection may be a critical factor in avoiding the exacerbation of an infection, adequate labeling for the nonabsorbable polypropylene surgical suture, as part of a standard, could state that it is a suture of choice in closing infected or contaminated wounds.

TVT mesh is considered by pelvic floor surgeons to be a large pore, lightweight mesh based on being an Amid Type I macroporous mesh, and based on the pores being the largest of any synthetic mesh available on the market in the United States to treat stress urinary incontinence. The pore size of TVT is large compared to the size of the pores that were previously used for pelvic floor repair, such as Gore-Tex, Marlex, and Mersilene. The pores are appropriate for the 1.1cm width of TVT, and the mesh construction of TVT has been used safely for over 17 years. TVT has been proven to be safe and effective in a variety of patients with similar results from a wide range of surgeons. A significant number of RCTs, long-term studies, registries, systematic reviews and Cochrane reviews have shown that TVT is reasonably safe for its intended use. The urogynecologic medical literature does not support the theory that TVT is a small pore mesh or that fibrotic bridging or pore collapse occurs in vivo. In fact, tissue ingrowth with TVT prevents pore collapse. The pore size and weight of TVT are appropriate and necessary to provide the good, lasting clinical results that we currently have. These excellent results from the vast body of clinical literature are consistent with Ulmsten's published results. I am in regular contact with surgeons from across the country and world at various professional society meetings and conferences, and I have never heard any respectable pelvic floor surgeon criticize the weight and pore size of TVT, or suggest that the pore size or weight of TVT are inadequate. I am aware of studies evaluating meshes, such as Vypro, with larger pores that are lighter in weight to TVT mesh that have not shown a decrease in complications. For example, in 2004, Denis[53] published on the results of using Vypro in pelvic floor repair for prolapse and found the tolerance results with Vypro mesh were very poor, there was a high rate of mesh erosions. The authors concluded that Vypro mesh offered "disappointing results of

[53] Denis (2004): ICS/IUGA Abstract: Pelvic Organ Prolapse Treatment by Vaginal Route Using a Vypro Composite Mesh: Preliminary Results About 106 Cases.

tolerance," and that "the use of a half absorbable mesh does not seem to reduce the inflammation and could even accentuate it." Further, the good results of TVT did not seem to be modified by the additional prolapse procedure. I am aware that Ethicon solicited feedback from pelvic floor surgeons to gauge their interest in a lighter weight, partially absorbable, larger pore mesh to be used in TVT, and the feedback did not suggest surgeons were interested in any changes to the TVT mesh.[54] I am also aware that Ethicon tested a lighter weight, larger pore, partially absorbable mesh, similar to Ultrapro, and the results showed that the mesh was too stretchy and would not be desirable for its intended use of treating stress urinary incontinence in a 1.1cm strip of mesh that would be placed under the midurethra.

The pore size and weight of TVT and TVT-O do not cause a clinically appreciable increase in inflammatory response in humans when evaluated in vivo. In a clinical study by Falconer[55] in 2001, the authors examined biopsies from the paraurethral connective tissue that were obtained intraoperatively from 16 women with stress urinary incontinence; all were operated on with the TVT procedure, 6 with Mersilene as the sling material and 10 with Prolene. Biopsies from 4 continent women with uterine bleeding irregularities, matched for age and parity, served as controls. New biopsies were obtained from all women after 2 years. The biopsies were examined histologically and analyzed for collagen concentration and solubility. An obvious inflammatory reaction with a significant increase in collagen extractability by pepsin was identified in patients where Mersilene was used as the sling material. A minimal inflammatory reaction without a significant change in collagen solubility was found in the Prolene group. In the control group no inflammatory reaction was seen. Mersilene gave rise to a significant foreign-body reaction in the paraurethral connective tissue after surgery. Such a reaction was not found with Prolene.

During the development of the TVT procedure different sling materials were used, such as Teflon, Gore-Tex, Mersilene, and Marlex. All these materials caused a significant amount of tape rejection. In a previous study Mersilene tape was found to induce a significant inflammatory reaction in paraurethral tissues, with a significant increase in collagen solubility by pepsin. Such a reaction can explain the high number of sling rejections when using this tape/sling material. In contrast, there is practically no tissue reaction at all seen 2 years after TVT surgery when

[54] Eth.Mesh.06377498
[55] Falconer (2001): Influence of Different Sling Materials on Connective Tissue Metabolism in Stress Urinary Incontinent Women.

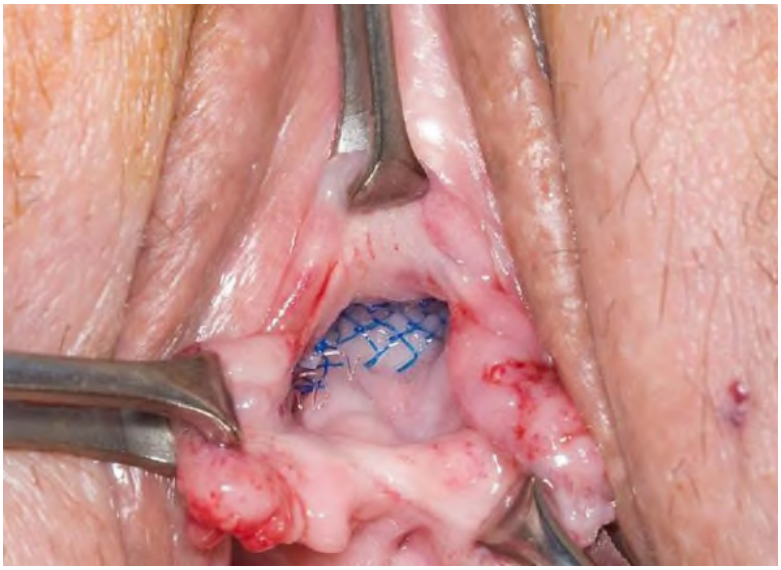
Prolene mesh was used (Fig. 3). In addition, no change in collagen extractability was found in the Prolene group (Fig. 1). There was no histological difference between paraurethral connective tissue in biopsies from patients operated on with Prolene tape and in controls 2 years after surgery. By the same token, there was no statistical difference in collagen concentration or extractability. The diminutive decrease in both these parameters, as observed in the control group, might be the result of age, compensated for in the Prolene group by a slight stimulation of the fibroblasts by the foreign material. This observation is in agreement with the clinical experience from ~80,000 TVT procedures using Prolene mesh with no tape rejections reported. The reports of no tape rejections after TVT operations with Prolene mesh support these experimental findings, suggesting Prolene mesh to be a suitable tape material for TVT surgery.

In fact, Professor Klinge, one of Plaintiffs' materials experts, authored a book chapter in Hernia Repair Sequelae[56] in 2010, in which he referred to TVT as the present "gold standard in SUI surgery." Klinge described how TVT replaced the Burch colposuspension: "Abdominal colposuspension was the procedure of choice for surgical management of SUI until 1995. When Ulmsten and Petros introduced the intra-vaginal slingplasty using polypropylene mesh, a procedure that was received with great enthusiasm because of its simplicity and short operating time. In a controlled randomized trial, this procedure was shown to have no inferiority in terms of efficacy as well as in the long term. Success rates reach 81%. Furthermore, it is advantageous in terms of fewer postoperative complications and less recovery lime compared with colposuspension."

Klinge then described how selecting an Amid Type I macroporous polypropylene mesh significantly reduced the incidence of mesh erosion. "The initial concern that the meshes used might lead to high rates of erosion did not hold true when macroporous polypropylene was used. In two long-term trials, the erosion rate was 1.7% and 3.1%, respectively. Most of the erosion was into the vagina, whereas erosion into the urethra or bladder was more or less anecdotal. However, low erosion rates in SUI depend on the selection of material. A prospective randomized controlled trial by Meschia et at showed that vaginal erosion of the Amid type III mesh used for intravaginal slingplasty was as high as 9% in a 2-year follow-up, which is significantly higher compared to 0% using the classical TVT (type I macroporous, monofilament,

[56] Kavvadias, Klinge (2010): Hernia Repair Sequelae – Ch. 56: Alloplastic Implants for the Treatment of Stress Urinary Incontinence and Pelvic Organ Prolapse.

polypropylene mesh) in the same trial." Klinge later goes on to describe mesh erosion as "not a major complication all in all." This goes to show Professor Klinge's lack of concern for his theory of effective porosity that is not adopted in the general medical community, or in his own literature as it relates to meshes for stress urinary incontinence. This could be explained the reduced amount and size of mesh used in a 1.1cm wide TVT sling compared to larger prolapse meshes, as Klinge noted by explaining that "small mesh surfaces, as used in TVT/TOT, shows a behavior different from that of large surfaces of the same material." In my experience in implanting, revising, and explanting TVT, I have never seen the mesh pores collapse. In this photo from Karram (2015), the TVT mesh exposure is consistent with how the mesh pores appear open to allow for tissue integration.



Pelvic floor surgeons are familiar with tensioning techniques and know the difference between tensioning an Autologous fascial sling at the bladder neck to adjusting the TVT sling at the midurethra using an object, such as metzenbaum scissors, a dilator, or a babcock, to counteract any tensioning under the midurethra. Surgeons previously learned the retropubic approach and tensioning techniques from performing Autologous fascial slings. What makes TVT tension free is the lack of suture fixation, as TVT is held in place by immediate tissue integration. Previously, sutured repairs were considered to be "with tension." TVT is tension-free compared to alternative procedures. Similar to surgeons using their surgical judgment about how to adjust the sling to reduce any slack with an Autologous fascial sling, surgeons use that same judgment when adjusting the TVT mesh. The sheath covering the TVT mesh protects again tensioning and stretching.

The utility of TVT outweighs the risks of harm as shown through the position statements of all major professional societies of surgeons who treat stress urinary incontinence, along with data from Cochrane Reviews and other systematic reviews of the literature which have confirmed TVT's safety profile and utility compared to alternative procedures. TVT avoids abdominal incisions, avoids stripping fascia, results in less voiding dysfunction that fascial slings, reduces the need for home catheter use, is less invasive, provides quicker recovery to normal activities, and has a favorable complication profile compared to Burch and Fascial sling.

The design of TVT is desirable because the sheath protects against contamination and over-stretching. The Amid Type I TVT mesh with pores greater than 75 microns to allow for macrophages to enter and for appropriate tissue integration. The vaginal approach is more desirable as it less invasive than an open abdominal approach, decreases the risk of hitting the bladder, and avoids other general surgical risks associate with open abdominal procedures. TVT is a standardized procedure which allows for common interpretation of the published literature. The cough test under local anesthesia allows for immediate feedback regarding a patient's continence. TVT can be used under local or general anesthesia, and generally less time is spent under anesthesia than with Burch and Autologous Fascial Slings, which require general anesthesia and have longer operating times, more voiding problems, and longer recovery times. TVT has been tested in various women with a wide range of BMIs, ages, and severity of incontinence. TVT is also effective in treating mixed incontinence, ISD, and recurrent incontinence. TVT is also appropriate for more frail patients who couldn't undergo the more morbid alternative procedures.

The complications that are associated with TVT and TVT-O are acceptably low and generally easy to manage. Although TVT comes with the unique risk of mesh exposure that does not necessarily accompany alternative procedures, surgeons are aware of dealing with mesh exposures from performing other synthetic suburethral sling procedures as well as abdominal sacrocolpopexy procedures. Mesh erosion and exposure have been documented in the medical literature for decades with various types of slings. Further, mesh exposures are often asymptomatic and are easy to treat. TVT is like every other medical device and there is always the possibility that it will need to be removed – that doesn't constitute a defect. My clinical experience is that it's not difficult to remove. It may need to be removed or revised under certain circumstances, but usually only the portion under the midurethra. No suggestion

that remaining mesh causes harm. TVT is the most studied product used in women and has been safely used in millions of women.

I am aware of a handful of publications[57] that comingle the discussion of complications with pelvic organ prolapse meshes and stress urinary incontinence slings, and find those publications to be misleading in the context of the risk benefit profile of TVT. These articles present the same dangers of confusion that the FDA's Public Health Notification created by mixing together complications associated with POP meshes and SUI slings.

In a 2015 study by Karram[58], he discussed how to manage complications associated with midurethral slings and concluded that "Synthetic midurethral slings are currently felt by most to be the gold standard surgical treatment for women with SUI. Multiple studies have demonstrated low rates of complications. Proper techniques in placement of the sling and appropriate patient selection are the keys to good long-term outcomes." He also described how synthetic midurethral slings (MUS) have become the most popular and efficacious incontinence procedures performed in the twenty-first century. No other innovation for the treatment of stress urinary incontinence (SUI) has had more appeal to surgeons and patients. These procedures generally have been shown to be minimally invasive and have a high efficacy rate with very low morbidity and a quick recovery period. Studies have shown that experience plays a major role in perforations, with rates of 1 % in experienced hands and 35 % in the hands of novice surgeons. Urethral injury can occur during the placement of any synthetic midurethral sling and is quite rare. Mesh erosion (Fig. 4) and extrusion is a known complication of all synthetic mesh systems. In a series of 241 women, Abouassaly et al. reported a 1 % vaginal erosion rate after TVT [2]. Initial treatment after diagnosis is typically conservative with use of vaginal estrogen cream and avoidance of vaginal insertions or trauma including pelvic rest and avoiding tampon use. If conservative treatment is unsuccessful, applicable surgical options include mobilization and reapproximation of vaginal epithelium, excision of the exposed mesh, or extensive or complete removal of the suburethral portion of the mesh. Retropubic midurethral slings may induce some immediate post-operative pain which is usually transient. Rarely do patients have persistent pain or de novo dyspareunia after the immediate post-operative period with TVT. Surgeons such as Karram publish their techniques for procedures

[57] Abbott (2014), Blaivas (2014), Blandon (2009), and Rogo-Gupta, Raz (2013).
[58] Karram (2015): Avoiding and Managing Complications of Synthetic Midurethral Slings.

such as sling loosening or sling takedowns to share their experiences with other surgeons. Dealing with complications is a part of performing any surgery.

Karram[59] also published in 2012 that "the development of midurethral sling kits has revolutionized the surgical treatment of stress urinary incontinence with excellent long-term efficacy and acceptable complication rates. "When mesh is exposed in the lumen of the vagina (should occur in <3% of cases) it only needs to be treated if it becomes symptomatic."

The Burch and Autologous Fascial Slings come with their own set of unique complications that can be substantially more severe and serious than a mesh exposure. See comparative TVT vs. Autologous Sling article by Sharifiaghdas (2008)[60].

	TVT (n = 25)	Sling (n = 36)	p
Perioperative			
Mean duration of operation, min	45 (30–70)	80 (50–180)	0.01
Bladder penetration	6 (24)	2 (8)	0.05
Bleeding (≥250 ml)	1 (4)	1 (5)	1.00
Mean catheterization time, days	1.3 (1–5)	4.6 (3–6)	0.001
Mean hospital stay, days	2 (1–5)	5 (3–7)	0.001
Operative complications			
6- to 12-month follow-up			
Residual urine >100 ml	1 (4)	5 (14)	0.4
Release of sling patient	1 (4)	2 (5)	1.00
More than 1-year follow-up			
Self-reported de novo urge incontinence	1 (4)	8 (22)	0.1
Changes in voiding pattern	5 (20)	11 (31)	0.5

Figures in parentheses indicate percentages or ranges.

Albo (2007) found: "A total of 655 women were randomly assigned to study groups: 326 to undergo the sling procedure and 329 to undergo the Burch procedure; 520 women (79%) completed the outcome assessment. At 24 months, success rates were higher for women who underwent the sling procedure than for those who underwent the Burch procedure, for both the overall category of success (47% vs. 38%, P = 0.01) and the category specific to stress incontinence (66% vs. 49%, P<0.001). However, more women who underwent the sling procedure had urinary tract infections, difficulty voiding, and postoperative urge incontinence.

[59] Zoorob, Karram (2012): Management of Mesh Complications and Vaginal Constriction.
[60] Sharifiaghdas (2008): Tension-Free Vaginal Tape and Autologous Rectus Fascia Pubovaginal Sling for the Treatment of Urinary Stress Incontinence: A Medium-Term Follow-Up.

"The Autologous fascial sling results in a higher rate of successful treatment of stress incontinence but also greater morbidity than the Burch colposuspension."

Serious adverse events occurred in 10% of Burch patients and 13% of Autologous Sling patients, and adverse events occurred in 47% of Burch patients and 63% of Autologous Sling patients.

Table 2. Adverse Events.*

Event	Burch Procedure (N=329)	Sling Procedure (N=326)	P Value†
	no. (%)		
Serious adverse events‡			
Patients with event	32 (10)	42 (13)	0.20
Total events	39	47	
Genitourinary	22	30	0.12
Ureteral injury	2	0	
Ureterovaginal fistula	1	0	
Incidental vaginotomy	1	0	
Incidental cystotomy	10	2	
Erosion of suture into bladder	1	0	
Recurrent cystitis, leading to diagnostic cystoscopy	5	6	
Pyelonephritis	1	1	
Catheter complication	1	1	
Voiding dysfunction leading to surgical revision	0	20	
Pelvic pain	0	2	0.25
Bleeding	3	1	0.62
Wound complication requiring surgical intervention	13	11	0.83
Gastrointestinal	1	1	1.00
Respiratory distress requiring intubation	0	1	0.50
Laryngospasm requiring reintubation	0	1	0.50

- Wound complications requiring surgical intervention included incisional hernia (Burch,5 patients; sling, 3), seroma or hematoma (Burch, 2; sling, 3), infection (Burch, 2; sling, 2), abscess (Burch, 1; sling, 1), and vaginal wound revision (Burch, 3; sling, 2).

- Wound complications not requiring surgical intervention included 2 sling exposures (visualization of the sling material in the vagina), incisional hernia (Burch group, 2; sling group, 1), superficial wound-edge separation (Burch, 10; sling, 5), seroma or hematoma (Burch, 13; sling, 11), infection (Burch, 31; sling, 21), and granulation tissue or stitch granulomas (Burch, 13; sling, 31).

Table 2. (Continued.)

Event	Burch Procedure (N = 329)	Sling Procedure (N = 326)	P Value†
	no. (%)		
Adverse events§			
Patients with event	156 (47)	206 (63)	<0.001
Total events	305	415	
Genitourinary	203	305	<0.001
Cystitis	202	299	
Pyelonephritis	1	6	
Vascular or hematologic	5	9	0.29
Deep-vein thrombosis	0	1	
Bleeding	5	8	
Wound complication not requiring surgical intervention	69	71	0.69
Gastrointestinal	7	8	0.80
Pulmonary	10	9	1.00
Neurologic	6	5	1.00
Cardiovascular	0	2	0.25
Allergic (hives, itching)	0	2	0.25
Constitutional	3	0	0.25
Dermatologic (rash, erythema)	2	4	0.45

- "Our data show that the pubovaginal fascial sling has significantly higher efficacy than the Burch abdominal colposuspension at 24 months in women with predominant stress incontinence, but such success comes at the cost of more complications. Clinicians should discuss such tradeoffs when making recommendations to patients regarding the optimal procedure and should emphasize that complete resolution of incontinence symptoms after surgery is unlikely."

Albo/Kenton (2012): TOMUS 2 year adverse events: Results: Of 597 randomized participants 516 (86.4%) were assessed. Objective success rates for retropubic and transobturator mid urethral slings were 77.3% and 72.3%, respectively (95% CI for difference of 5.1% was -2.0, 12.1), and subjective success rates were 55.7% and 48.3%, respectively CCI for difference of 7.4% was -0.7, 15.5). Neither objective nor subjective success rates met the prespecified criteria for equivalence. Patient satisfaction (retropubic 86.3% vs transobturator 88.1 %, p = 0.58), frequency of de novo urgency incontinence (retropubic 0% vs transobturator 0.3%, p = 0.99) and occurrence of mesh exposure (retropubic 4.4% vs transobturator 2. 7%, p = 0.26) were not significantly different. The retropubic mid urethral sling group had higher rates of

voiding dysfunction requiring surgery (3.0% vs 0%, p = 0.002) and urinary tract infections (17.1% vs 10.7%, p = 0.025), whereas the transobturator group had more neurological symptoms (9. 7% vs 5.4%, p = 0.045).

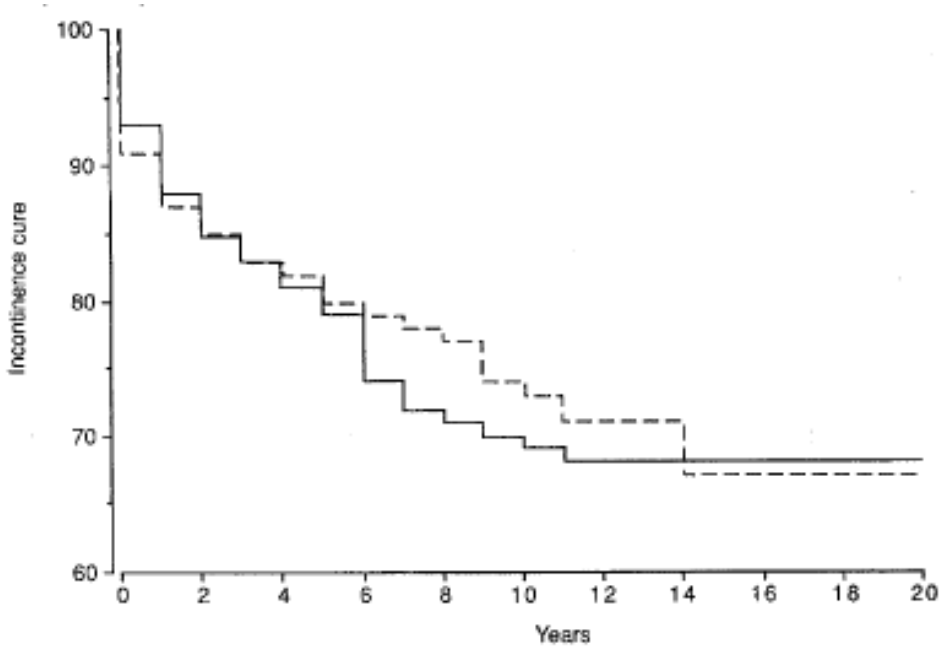
	Retropubic (298)			Transobturator (299)		
	Total Events	No. Events in 13–24 Mos	No. Unique Pts (%)*	Total Events	No. Events in 13–24 Mos	No. Unique Pts (%)*
Grades III–IV, requiring surgical, endoscopic or radiological intervention						
Wound:	11	1	10 (3.4)	11	6	11 (3.7)
Mesh exposure‡	10	1	9 (3.0)	6	5	6 (2.0)
Mesh erosion§	1	0	1 (0.3)	1	0	1 (0.3)
Surgical site infection	0	0	0 (0)	3	1	3 (1.0)
Granulation tissue	0	0	0 (0)	1	0	1 (0.3)
Grades I–II, expectant or pharmacological intervention						
Wound:	6	0	6 (2.0)	2	−3	2 (0.7)
Mesh exposure‡	4	0	4 (1.3)	2	−1**	2 (0.7)
Mesh erosion§	0	0	0 (0)	0	0	0 (0)
Surgical site infection	2	0	2 (0.7)	0	−2††	0 (0)

Kenton's (2015) TOMUS 5 year follow-up found that midurethral slings are the most commonly performed surgeries for women with stress urinary incontinence. Approximately 200,000 SUI surgeries are performed annually in the United States, increasing 27% from 2000 to 2009. Conclusions: Treatment success decreased during 5 years for retropubic and transobturator slings, and did not meet the prespecified criteria for equivalence with retropubic demonstrating a slight benefit. However, satisfaction remained high in both arms. Women undergoing a transobturator sling procedure reported more sustained improvement in urinary symptoms and sexual function. New mesh erosions occurred in both arms over time, although at a similarly low rate.

Moen, Elser, Matthews et al.[61] reported that "Synthetic midurethral sling results in a significantly lower rate of any post-operative incontinence symptoms than Burch urethropexy, in stress urinary incontinent women undergoing Abdominal Sacrocolpopexy, with no significant difference in irritative bladder symptoms.

[61] Moen (2009): A Comparison of Midurethral Sling Versus Burch Urethropexy for Treating Urodynamic Stress Incontinence at the time of Abdominal Sacrocolpopexy.

Long-term studies on Burch and Autologous Fascial Slings are not robust. Alcalay[62] published 10-20 year (13.8 year mean follow-up) results for Burch colposuspension and found a decline in cure rates down to 69%. Post-operative complications included de novo detrusor instability (14.7%), long-term complaints of voiding difficulty (22%), 14.7% constipation, and five patients who underwent enterocele repair.. In 1995, Alcalay noted that there were over 100 operations described to cure stress incontinence, and, as of 1995, there was still no consensus on the surgical procedure for its correction.



Alcalay also noted other long-term studies evaluating Burch. “Three 10 year follow up studies have been published recently. Herbertsson and losif (1993) reported a 90 % objective cure rate following colposuspension but did not separately examine objective and subjective cure. In addition, they used stress urethral pressure profilometry as an outcome measure, which is not an accepted proof of cure. Feyereisl et al. (1994) found a 82 % cure of stress incontinence in 87 patients followed up for five to ten years; no difference was found between primary and secondary surgery. They excluded patients with marked prolapse and found that a maximum urethral closure pressure less than the patient's age (irrespective of an upper limit of 20 cmHp) represented a risk factor. Laursen et al. (1994) reviewed 771 patients from one to eighteen years. The follow up was only by a standardized questionnaire and the overall subjective success rate at 18 years (by survival analysis) was 54%. “Voiding difficulty is a recognised complication after colposuspension.”

[62] Alcalay (1995): Burch colposuspension: a 10-20 year follow-up.

Kjolhede[63] also published on known long-term complications associated with the Burch procedure in 1996, including: "voiding difficulties, de novo detrusor instability, recurrent cystitis, dyspareunia, and utero-vaginal prolapse have been frequently observed. The incidence of utero-vaginal prolapse after the Burch colposuspension varies between 7.6% and 66%."

Demirci[64] also published on complication rates associated with the Burch colposuspension and found "At follow-up, late complications in 220 women were: cystocele in 18; rectocele in 32; enterocele in 35; dyspareunia in 6, and groin or suprapubic pain in 15. In group I, of the 11 women with detrusor instability preoperatively, 10 were cured and in 1 detrusor instability persisted postoperatively. The cure rate at 4.5 year follow-up was 77.4%. Dyspareunia occurred in 6/220 patients (2.7%) and groin or suprapubic pain in 15/220 patients (6.8%). Demirci noted one of the problems with early studies evaluating traditional procedures: "the studies which reported cure rates of Burch colposuspension are usually performed on a small number of patients and reported short-term follow-ups." The symptom-free cure rate declined 83.9% for 3, 76.2% for 4, 75% for 5 and 68% for 6 years. Van Geelen et al. reported an objective cure rate after 3 months of 100% and at 1-2 years it was 85%. However, 5 years after the procedure only 75.8% of the women were symptom-free. Thunedborg et al. reported a complete cure rate of 78.6% for 6 years, Kinn reported 78% for 5 years, Eriksen et al. reported 67% for 5 years, Lebret et al. reported 64% for 5 years, Kjolhede and Ryden reported 6 3% for 6 years and Christensen et al. reported 33%. These earlier and long-term results are comparable with our results. In contrast to these results, Herbertson and Iosif reported a 90.3% cure rate for 9.4 years.

Galloway published results from Burch Colposuspension showing only 44% were dry and complication-free in the long-term. He concluded that there were an "unacceptable number of complications in both the short and longer term (Table 3)," showing 4% dyspareunia and 16% voiding dysfunction.

[63] Kjolhede (1996): Prediction of genital prolapse after Burch Colposuspension.
[64] Demirci (2001): Long-Term Results of Burch Colposuspension.

Table 3 Complications

	No.
Persistent incontinence	8
Voiding difficulties	8
Urge syndrome	7
"Post-colposuspension syndrome"	6
Uterine prolapse	2
Enterocele	2
Dyspareunia	2
Recurrent incontinence	2

Wang[65] also published complications from Burch Colposuspension:

Table II *Complications*

Complication	Burch colposuspension (n = 294)	Stamey operation (n = 209)
Voiding dysfunction	28	33
Wound infection	12	8
Enterocele	19	0
Suprapubic pain	7	4
Detrusor instability	19	26
Suture pledget pull-through	0	5
Hemorrhage	2	1
Urethral injury	0	2
Cystotomy	7	0
Dyspareunia	6	5
Vesicovaginal fistula	1	0
Urinary tract infection	20	28

Laursen (1994) also published on Burch complication rates: "Among successes and failures were voiding difficulty, frequency, nocturia and Burch pain syndrome 28%,41%, 10%, 20% and 66%,81%, 35%, 37%, respectively. p< 0.D1 (Chi-square test) . Age, body- mass-index, parity and hysterectomy were of no risk in the outcome of surgery.

[65] Wang (1996): Burch Colposuspension vs. Stamey Bladder Neck Suspension.

Schimpf (2014) SGS Systematic Review[66]: For midurethral slings (MUS) vs Burch, metaanalysis of objective cure showed no significant difference (OR, 1.18; 95% confidence interval [CI], 0.73e1.89). Therefore, we suggest either intervention; the decision should balance potential adverse events (AEs) and concomitant surgeries. For women considering pubovaginal sling vs Burch, the evidence favored slings for both subjective and objective cure. We recommend pubovaginal sling to maximize cure outcomes. For pubovaginal slings vs MUS, metaanalysis of subjective cure favored MUS (OR, 0.40; 95% CI, 0.18e0.85). Therefore, we recommend MUS. For obturator slings vs retropubic MUS, metaanalyses for both objective (OR, 1.16; 95% CI, 0.93e1.45) and subjective cure (OR, 1.17; 95% CI, 0.91e1.51) favored retropubic slings but were not significant. Metaanalysis of satisfaction outcomes favored obturator slings but was not significant (OR, 0.77; 95% CI, 0.52e1.13). AEs were variable between slings; metaanalysis showed overactive bladder symptoms were more common following retropubic slings (OR, 1.413; 95% CI, 1.01e1.98, P = .046). We recommend either retropubic or obturator slings for cure outcomes; the decision should balance AEs. For minislings vs full-length MUS, metaanalyses of objective (OR, 4.16; 95% CI, 2.15e8.05) and subjective (OR, 2.65; 95% CI, 1.36e5.17) cure both significantly favored full-length slings. Therefore, we recommend a full-length MUS.

[66] Schimpf (2014): Sling Surgery for stress urinary incontinence in women: a systematic review and metaanalysis.

Rates of AEs by sling type analyzed from randomized controlled trials and included AE studies[1,9-57,59-117]

Sling category	Studies	Summary estimate of incidence (95% CI)	Events	Total n	Range of AE proportions across studies
Estimated blood loss >200 mL					
Obturator	4	0.22% (0.03–1.59%)	1	448	0.00–1.79%
Minisling	3	1.1% (0.5–1.9%)	10	888	0.00–3.68%
Retropubic	4	1.5% (1.0–2.1%)	33	2071	0.21–4.76%
Transfusion					
Burch	3	0.00% (0.00–7.73%)	0	105	0.00–0.00%
Obturator	6	0.17% (0.02–1.22%)	1	584	0.00–0.40%
Retropubic	13	0.40% (0.28–0.55%)	31	8105	0.00–4.00%
Minisling	5	0.51% (0.23–1.14%)	6	1177	0.00–0.74%
Pubovaginal	5	1.9% (0.9–3.2%)	10	515	0.00–5.17%
Hematoma					
Obturator	18	0.59% (0.35–0.89%)	17	2995	0.00–2.41%
Retropubic	25	0.88% (0.74–1.0%)	184	15,950	0.00–16.13%
Minisling	2	0.85% (0.21–3.44%)	2	236	0.74–1.00%
Burch	4	1.4% (0.6–2.6%)	8	542	0.00–5.71%
Pubovaginal	5	2.2% (1.2–3.4%)	14	677	0.00–5.17%
Dyspareunia					
Retropubic	2	0.00% (0.01–1.64%)	0	488	0.00–0.00%
Obturator	6	0.16% (0.02–1.14%)	1	624	0.00–0.40%
Minisling	11	0.74% (0.40–1.2%)	19	1809	0.00–6.49%
Pubovaginal	5	0.99% (0.39–1.9%)	8	696	0.00–2.63%
Return to operating room for erosion					
Burch	2	0.28% (0.04–2.03%)	1	352	0.00–0.30%
Minisling	3	1.4% (0.5–2.8%)	5	399	0.53–2.86%
Pubovaginal	5	1.6% (0.8–2.7%)	16	640	0.00–12.50%
Retropubic	12	1.9% (1.0–3.0%)	13	703	0.00–6.45%
Obturator	7	2.7% (1.5–4.3%)	14	518	0.00–8.24%
Exposure					
Burch	4	0.00% (0.02–6.22%)	0	130	0.00–0.00%
Retropubic	29	1.4% (1.1–1.7%)	84	5684	0.00–12.90%
Minisling	19	2.0% (1.5–2.6%)	61	2408	0.00–19.05%
Obturator	31	2.2% (1.7–2.7%)	66	3253	0.00–10.00%
Pubovaginal	10	5.4% (4.0–7.0%)	48	851	0.00–15.52%
Wound infection					
Minisling	3	0.31% (0.05–0.80%)	2	852	0.00–1.04%
Obturator	14	0.74% (0.43–1.1%)	14	2348	0.00–2.11%

Schimpf. Sling surgery for stress urinary incontinence. Am J Obstet Gynecol 2014. (continued)

TABLE 3
Rates of AEs by sling type analyzed from randomized controlled trials and included AE studies[1,9-57,59-117] (continued)

Sling category	Studies	Summary estimate of incidence (95% CI)	Events	Total n	Range of AE proportions across studies
Pubovaginal	10	12% (10.2–14%)	158	1053	3.03–81.97%
Burch	5	17% (13–21%)	55	288	0.00–32.88%
Retention lasting >6 wk postoperatively					
Obturator	6	2.4% (1.4–3.6%)	70	2629	0.00–10.00%
Retropubic	9	2.7% (2.1–3.4%)	248	7127	0.00–21.74%
Minisling	2	3.3% (1.6–5.7%)	36	1778	0.00–5.88%
Pubovaginal	6	7.5% (5.4–10%)	158	1053	3.03–81.97%
Burch	4	7.6% (4.7–11%)	55	288	0.00–32.88%
Return to operating room for urinary retention					
Burch	4	0.00% (0.00–1.54%)	0	522	0.00–0.00%
Obturator	22	1.1% (0.7–1.5%)	23	2342	0.00–6.67%
Retropubic	21	1.2% (0.9–1.7%)	48	3103	0.00–24.00%
Minisling	12	1.9% (1.2–2.9%)	16	970	0.00–5.00%
Pubovaginal	15	3.0% (2.3–3.9%)	57	1667	0.00–7.69%
Groin pain					
Pubovaginal	2	0.34% (0.09–1.36%)	2	591	0.00–0.61%
Minisling	12	0.62% (0.30–1.1%)	14	1619	0.00–5.26%
Burch	2	1.10% (0.42–2.98%)	4	364	0.00–11.43%
Retropubic	12	1.5% (1.0–2.1%)	29	1811	0.00–5.56%
Obturator	17	6.5% (5.3–7.7%)	128	1594	0.00–36.67%
Leg pain					
Retropubic	4	0.62% (0.16–2.51%)	2	322	0.00–1.69%
Minisling	4	1.6% (0.5–3.2%)	4	337	0.00–2.63%
Obturator	7	16% (13–19%)	112	649	3.66–60.87%
Bladder perforation					
Obturator	32	0.70% (0.46–0.98%)	22	4000	0.00–4.76%
Minisling	6	0.85% (0.40–1.5%)	12	1138	0.00–4.41%
Pubovaginal	14	2.3% (1.5–3.3%)	23	1069	0.00–5.56%
Burch	10	2.8% (1.7–4.1%)	19	753	0.00–6.25%
Retropubic	41	3.6% (3.3–3.9%)	420	11,390	0.00–24.39%
Urethral perforation					
Burch	1	0.00% (0.00–34.04%)	0	25	0.00–0.00%
Obturator	7	0.20% (0.05–0.80%)	2	1013	0.00–1.72%
Retropubic	8	0.41% (0.19–0.72%)	17	2211	0.00–5.37%
Minisling	1	2.70% (0.38–20.26%)	1	37	2.70–2.70%

Schimpf. Sling surgery for stress urinary incontinence. Am J Obstet Gynecol 2014. (continued)

- Midurethral sling vs Burch (open or laparoscopic) For women considering midurethral slings or Burch procedures for treatment of SUI, we suggest either intervention for objective and subjective cure and that decision be based on: (1) which adverse events are of greatest concern to patient; and (2) any other planned concomitant surgeries (vaginal vs abdominal route). (1A)

- Midurethral slings may result in lower rates of perioperative adverse events such as blood loss, postoperative pain, operating room time, hospital stay, bowel injury, wound infection, and hematomas. (1C) Pubovaginal sling (biologic and synthetic) vs midurethral sling (only TVT was studied) For women considering pubovaginal or midurethral sling for treatment of SUI, we recommend midurethral sling for better subjective cure outcomes. (2C)_

- Midurethral slings may result in lower rates of perioperative outcomes such as operating room time, blood loss, and hospital stay. (2D)

The AUA's 2012 Appendix shows higher complication rates with Burch and Autologous slings related to pain and sexual dysfunction than with midurethral slings. Complications of suprapubic pain are risks of open abdominal procedures. In Demirici's 2001 study, he found: At follow-up, late complications in 220 women were: cystocele in 18; rectocele in 32; enterocele in 35; dyspareunia in 6, and groin or suprapubic pain in 15. In group I, of the 11 women with detrusor instability preoperatively, 10 were cured and in 1 detrusor instability persisted postoperatively. Two women had de novo detrusor instability. In conclusion, the cure rate of Burch colposuspension is satisfactory, although it declines a little with time." Further, "Dyspareunia and groin pain were rare complications of the Burch procedure in the late period. Suspension sutures are responsible for groin or suprapubic pain. They pull the anterior vaginal wall up and change the vaginal axis therefore they are responsible for dyspareunia.· We found 2.7% dyspareunia and 6.7% groin or/and suprapubic pain. Dyspareunia was reported in 2% by Wang [21], 2.9% by Galloway et al. [20], 3.5% by Eriksen et al. [8] and 4% by Galloway et al. [20]. Galloway et al. [20] and Wang [21] reported postoperative groin/suprapubic pain in 12 and 2.4%, respectively." Long-term cure rates for the Burch colposuspension have been reported around 70%.[67]

Based on my experience, talking with my colleagues at other teaching institutions, and reviewing the literature, the Burch colposuspension and Autologous Fascial Sling procedures are rarely taught in residency and fellowship programs. Walters (2012)[68] found that: "Almost all surgical procedures for stress urinary incontinence performed today involve placement of a retropubic or transobturator midurethral synthetic sling." "Although Burch colposuspension and

[67] Alcalay (1995): Burch Colposuspension: 10-20 year follow-up.
[68] Walters (2012) Which sling for which SUI patient?

the pubovaginal fascial sling procedure are effective for both primary and recurrent SUI, they are more invasive than midurethral slings, cause more voiding dysfunction, and have significantly longer recovery times, making them less attractive for most primary and recurrent cases of SUI." Further, he noted that "The evolution of SUI surgeries has shifted so far toward midurethral slings that Burch colposuspension and the pubovaginal sling procedure are rarely performed or taught in obstetrics and gynecology or urology residency programs; these procedures are now mostly done in fellowship programs by specialists in female pelvic medicine and reconstructive surgery." Walters reported that serious complications are uncommon, with mesh exposures occurring at a rate of about 1-2%."

A Valpas (2004) review noted that "Since the introduction of the TVT procedure hundreds of clinical reports have been published, while studies on the laparoscopic colposuspension technique are limited." Other studies found 92% cure in the TVT group and 88.2% cure in the laparoscopic colposuspension group, with the TVT group using few analgesics, hospital time was shorter, and return to normal voiding was significantly faster.

Two larger, systematic national registries on complications associated with the TVT procedure have been established in Austria and Finland. The Austrian registry (n = 2795) identified a bladder perforation rate of 2.7%. A total of 68 patients (2.4%) required reoperation of some kind: 39 to loosen, remove, or cut the tape, or to place a suprapubic catheter, 19 for haematoma and one for bowel injury [28]. The nationwide Finnish study of 1455 patients identified a bladder perforation rate of 3.8%, with short-term urinary retention occurring in 2.3% and mild voiding difficulties during the first 24 h following surgery in 7.6% of cases. No life-threatening complications occurred [29].

By now, some 700,000 TVT operations have been performed worldwide. The TVT procedure is one of the most documented incontinence procedures. Systematic prospective trials including different subgroups of incontinence patients have shown the safety and efficacy of the operation. The incidence of complications associated with any incontinence operation has never been so thoroughly investigated – on a prospective basis – as has that of the TVT operation. Documentation on laparoscopic colposuspension is far more limited. As the TVT operation has proven to be effective in most clinical situations, it can be recommended as the first-line surgical procedure for the treatment of female SUI.

TVT slings do not operate similar to prolapse meshes. There are several studies reporting no shrinkage of TVT, thus confirming sufficient pore size and tissue integration. Nilsson (2013) reported: "An important observation is that there seems to be no shrinkage of the TVT over time." Dietz (2003) reported "the TVT does not seem to contract or shorten over a median observation period of 1.6 years." Lo (2004) concluded that "the observations of the tape position and characteristics suggest that shrinkage and compromise of the TVT sling does not occur." Lukacz (2003) concluded that "unchanged resting Q-tip angles confirm the tension-free concept and there appears to be no shrinkage or tightening of the sling." If TVT and TVT-O did contract significantly then I would expect the long-term urinary retention rate to be significantly higher.

Complications such as chronic pelvic pain and dyspareunia (pain with sex) are not unique to TVT or TVT-O. A 1996 study[69] of women aged 18-45 reported the prevalence of dysmenorrhea, dyspareunia, pelvic pain, and irritable bowel syndrome was 90, 46, 39, and 12%, respectively; all of which were described as common complaints among women of reproductive age. The study showed that "39% of women reported always, often, or sometimes having pelvic pain. Likewise, 45% of women reported dyspareunia with pain that lasted longer than 1 year in duration, and 52% reported pelvic pain 1 year or longer in duration. The prevalence of dysmenorrhea and dyspareunia previously reported in the literature vary widely, from 16 to 80% for dysmenorrhea and from 17 to 34% for dyspareunia.

Another study[70] from 1996 with the objective to determine the prevalence of chronic pelvic pain in U.S. women aged 18-50 years old showed that 773 (14.7%) of the 5,263 women reported chronic pelvic pain within the past 3 months. The authors concluded that although chronic pelvic pain is a common and serious problem for women, the cause of chronic pelvic pain is frequently undiagnosed, although it affects approximately one in seven U.S. women. Based on the authors' extrapolations, they estimated that out of a total of 62,701,000 women aged 18-50 years in the United States, that 9.2 million U.S. women may suffer from chronic pelvic pain.

[69] Jameison, Steege (1996): The Prevalence of Dysmenorrhea, Dyspareunia, Pelvic Pain, and Irritable Bowel Syndrome in Primary Care Practices.
[70] Mathias, Steege (1996): Chronic Pelvic Pain: Prevalence, Health-Related Quality of Life, and Economic Correlates.

Another study by Glatt[71] from 1990 reported that 27.5% of women in their study had dyspareunia at some point in their lives, while 33.5% still had dyspareunia at the time of the survey, almost half of whom had had dyspareunia for their entire active sexual lives. Among the surveyed women, 53.3% had persistent dyspareunia lasting longer than 4 months.

Chronic pain and dyspareunia have been known and common problems for women among the general population, even for those who have not undergone previous pelvic surgery. Similarly, chronic pain and dyspareunia are well known complications that can occur after any pelvic floor procedure. In 1961, Francis published "Dyspareunia Following Vaginal Operations," noting that dyspareunia was a well-accepted complication of operations which involve incision and suture of the vagina, and are variously explained." Another study by Sobhgol[72] reported that 54.5% of the women in their study had dyspareunia. Another study by Laumann[73] found that women experienced pain during sex in 21% of women aged 18-29, 15% in women aged 30-39, 13% in women aged 40-49, and 8% in women aged 50-59. The study concluded that sexual dysfunction was reported in 43% of women. In a 2002 study by Barber[74], at baseline, 24% and 16% of women with genuine stress incontinence reported almost always or always feeling pain or discomfort during sexual intercourse. ACOG[75] reported on the potential causes of chronic pelvic pain as including: endometriosis, pelvic adhesions, pelvic inflammatory disease, alterations of pelvic support, and pelvic varicosities. ACOG also noted that "it is uncommon for any single component (peripheral, central, or in between) to be totally responsible for a chronic pain syndrome."

It is now widely accepted that urinary incontinence has an adverse impact on sexual function resulting in coital incontinence and a variety of other symptoms with a negative impact on all domains of sexual function.[76] After analyzing 18 studies consisting of 1,578 women, the Jha meta-analysis found that the chances of improvement of sexual function were three times as likely as the chances of deterioration. The authors concluded that, "overall, sexual function is likely to remain unchanged, although there is a small possibility of improvement or even

[71] Glatt (1990): The Prevalence of Dyspareunia.
[72] Sobhgol (2007): Rate and related factors of dyspareunia in reproductive age women: a cross-sectional study.
[73] Laumann (1999): Sexual Dysfunction in the United States.
[74] Barber (2002): Sexual Function in Women with Urinary Incontinence and Pelvic Organ Prolapse.
[75] ACOG 1989 Technical Bulletin: Chronic Pelvic Pain
[76] Jha (2012): Impact of Incontinence Surgery on Sexual Function: A Systematic Review and Meta-Analysis.

deterioration following surgery." The study by Pace showed as high as 90.1% improvement with TVT. A study by Elzevier found that TVT "seems to have no negative impact on sexual function," and it "has a positive overall effect on sexual function" because of its successful outcome on incontinence.[77] Another study by Jha[78] concluded that "TVT significantly improves the overall sex lives of women with stress urinary incontinence."

The Urinary Incontinence Treatment Network published 2 year results[79] concluding that "Midurethral sling surgery for stress urinary incontinence significantly improves sexual function," and "neither synthetic mesh sling route that was studied was associated with increased dyspareunia."

The alleged defects raised by plaintiffs' experts do not rise to the level of causing complications. The clinical literature does not support the theory that TVT ropes, curls, degrades, loses particles, or has its pores collapse in vivo; nor does the clinical literature link any of these alleged defects to complications or an increase in complications. There is no biologic mechanism that demonstrates an increase in complications attributable to the way the mesh is cut; that the infection rate with the vaginal approach TVT is lower than alternative procedures; or that there is a link to confirmed in vivo degradation, cancer, or cytotoxicity. Extensive clinical trials on TVT do not show clinical complications or note any clinical significance or link to an increase in complications resulting from degradation, particle loss, roping, curling, or fraying.

The position statements from the largest professional societies composed of surgeons treating SUI make it clear that TVT is desired by surgeons as it has significant utility and benefits for women who suffer from SUI.

The American Urological Association's Position Statement states: **"**Suburethral synthetic polypropylene mesh sling placement is the ***most common surgery currently performed*** for SUI. ***Extensive data*** exist to support the use of synthetic polypropylene mesh suburethral slings for the treatment of female SUI, with ***minimal morbidity compared with alternative***

[77] Elzevier (2004): Sexual function after tension-free vaginal tape (TVT) for stress incontinence: results of a mailed questionnaire.
[78] Jha (2009): The impact of TVT on sexual function.
[79] Zyczynski (2012): Sexual acitivity and function in women more than 2 years after midurethral sling placement.

surgeries. Advantages include shorter operative time/anesthetic need, reduced surgical pain, reduced hospitalization, and reduced voiding dysfunction," and that "***synthetic slings are an appropriate treatment choice for women with stress incontinence, with similar efficacy but less morbidity than conventional nonmesh sling techniques***.

Similarly, the American Urogynecologic Society's (AUGS) and the Society of Urodynamics, Female Pelvic Medicine and Urogenital Reconstruction's (SUFU) Position Statement states that "The polypropylene mesh midurethral sling is the recognized ***worldwide standard of care*** for the surgical treatment of stress urinary incontinence. The procedure is safe, effective, and has ***improved the quality of life for millions of women,"*** and "As a knitted material, polypropylene mesh is the consensus graft material for augmenting hernia repairs in a number of areas in the human body and has significantly and favorably impacted the field of hernia surgery. As a knitted implant for the surgical treatment of SUI, ***macroporous***, monofilament, ***light weight*** polypropylene has demonstrated long term durability, safety, and efficacy up to 17 years." Furthermore, "The monofilament polypropylene mesh MUS is the ***most extensively studied*** anti-incontinence procedure in history. A broad evidence base including high quality scientific papers in medical journals in the US and the world supports the use of the MUS as a treatment for SUI. There are ***greater than 2000 publications*** in the scientific literature describing the MUS in the treatment of SUI. These studies include the highest level of scientific evidence in the peer reviewed scientific literature. The MUS has been studied in virtually all types of patients, with and without comorbidities, and all types of SUI. Multiple randomized, controlled trials comparing types of MUS procedures, as well as comparing the MUS to other established non-mesh SUI procedures, have consistently demonstrated its clinical effectiveness and patient satisfaction. Among historical SUI procedures, the MUS has been studied as long in follow-up after implantation as any other procedure and has demonstrated superior safety and efficacy. ***No other surgical treatment for SUI before or since has been subject to such extensive investigation***." The Position Statement goes on to state that full length midurethral slings ***"have been extensively studied, are safe and effective relative to other treatment options and remain the leading treatment option and current gold standard for stress incontinence surgery***. Over 3 million MUS have been placed worldwide and a recent survey indicates that ***these procedures are used by > 99% of AUGS members***."

The International Urogynecological Association's Position Statement states that, "Mid-urethral slings are ***minimally invasive*** procedures developed in Europe in the 1990s to treat female stress urinary incontinence," and that "they have been shown to be as effective as more invasive traditional surgery with ***major advantages of shorter operating and admission times, and a quicker return to normal activities together with lower rates of complications***. ***This has resulted in MUS becoming the operation of choice in Europe, Asia, South America, South Africa, Australasia and North America for treatment of SUI with several million procedures performed worldwide***."

ACOG and AUGS released a joint practice bulletin in November of 2015 in order to update the previous practice bulletin from 2005. This practice bulletin outlines the best practices for treating female urinary incontinence that are consistent with the best available scientific evidence. ACOG and AUGS recommends the following based on good and consistent scientific evidence (Level A):

- Initial midurethral sling surgery results in higher 1-year subjective and objective cure rates than pelvic floor physical therapy in women with stress urinary incontinence.

- Synthetic midurethral slings demonstrate efficacy that is similar to traditional suburethral fascial slings, open colposuspension, and laparoscopic colposuspension. Compared with suburethral fascial slings, fewer adverse events have been reported with synthetic midurethral slings. Voiding dysfunction is more common with open colposuspension than with synthetic midurethral slings.

- There are substantial safety and efficacy data that support the role of synthetic mesh midurethral slings as a primary surgical treatment option for stress urinary incontinence in women.

The TVT and TVT-O IFUs Adequately Warn of the Risks Associated with the Products:

Complications associated with stress urinary incontinence surgeries are well-known and obvious to pelvic floor surgeons performing those types of procedures. The same is true for complications associated with the implantation of any foreign body which can potentially result in the material becoming exposed or eroded. I have reviewed all of the TVT and TVT-O IFUs as

well as the FDA Blue Book guidance, 21 CFR 801.109(c), the Ethicon SOP regarding Regulatory Labeling Guidance, and testimony from Ethicon employees, and as a pelvic floor surgeon who has performed thousands of midurethral slings, and who has taught other surgeons on the procedure and the IFU, it is my opinion to a reasonable degree of medical certainty that the IFU appropriately and adequately informed surgeons of the relevant risks associated with the TVT and TVT-O. Additionally, Ethicon's Professional Education materials served as an excellent supplement to the IFU in instructing physicians on the safe and effective use of TVT and TVT-O.

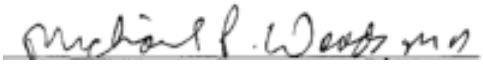
Further, all of the risks, including their general frequency and severity, in the 2015 IFU are commonly known to pelvic floor surgeons performing sling procedures. Surgeons learn about SUI surgery complications, graft properties, and graft complications in medical school, residency, fellowship, as well as through their continued review of the medical literature and textbooks, attendance at professional society and continuing education meetings, discussions with colleagues, and while studying for board exams. [ACGME Program Requirements for Graduate FPMRS, ABOG and ABU Guide to Learning in FPMRS, AUA National Medical Student Curriculum, AUGS Resident Learning Objectives, IUGA Guideline for Training in FPMRS]. Well-known complications that can result after any pelvic floor or incontinence procedure includes, but is not limited to the following, regardless of whether or not mesh is involved in the surgical repair: acute and/or chronic pain, voiding difficulties (urge incontinence, urinary frequency, urinary retention), adhesion formation, atypical vaginal discharge, death, pain with intercourse that may never resolve, the need for one or more surgeries to treat adverse reactions, recurrence of incontinence, bleeding (hemorrhage or hematoma), neuromuscular problems including acute and/or chronic pain in the groin, thigh, leg, pelvic and/or abdominal area, over correction i.e., too much tension that may result in temporary or permanent lower urinary tract obstruction, punctures or lacerations of vessels, nerves, structures or organs, including the bladder, urethra or bowel, may occur and may require surgical repair, seroma, and transitory local irritation at the wound site may occur. The only unique complication of using mesh for incontinence procedures such as TVT is the well-known complications of mesh erosion or exposure, which is a risk of any foreign body implant. [FDA 2013 Considerations about Surgical Mesh for SUI; AUGS/SUFU 2014; AUA 2011 and 2013]. Mesh exposures have been documented in the medical literature for numerous graft materials, including polypropylene meshes, years before TVT was available. Further, Ethicon warned of mesh erosion since the first version of the IFU was in use. Therefore, Ethicon appropriately warned of the risks specific

to the device, even though these risks were well known to pelvic floor surgeons performing incontinence procedures. The criticisms that plaintiffs' experts have about the IFU's lack of warnings related to alleged mesh characteristics or mechanisms, that they speculate can lead to clinically significant complications, are unfounded in science based on my clinical experience, education, training, discussions with colleagues, and thorough review of the medical literature.

As a preceptor for Ethicon, I can attest to the discussions at training events regarding the adequacy of the IFUs, the risks, the frequency and severity of the risks reported in the scientific peer-reviewed literature, and the discussions about how to manage complications, which are not too different from managing complications. The increased warnings in the IFUs in 2015 do not indicate that the previous IFUs were inadequate or misleading, but rather, serve as a response to the legal and regulatory environment regarding pelvic mesh. As a surgeon who has been implanting synthetic midurethral slings for almost two decades, who has experience performing Burch and autologous sling procedures, who has managed complications after midurethral sling, Burch, and autologous sling procedures, who has continuously reviewed the published scientific literature on frequency and severity of known complications associated with stress urinary incontinence procedures, who has taught other surgeons on the adequacy of the IFU in formal professional education settings, and who has an understanding of the regulatory requirements for IFUs, I am prepared to testify as to why the TVT and TVT-O IFUs are accurate, adequate, and appropriate for warning surgeons of the risks associated with those products, and whether or not certain risks are commonly known by pelvic floor surgeons.

In fact, after the FDA performed their own safety analysis of the medical literature and MAUDE database complaints associated with full-length midurethral slings, such as TVT and TVT-O, the FDA concluded that full-length slings were safe and effective, and did not recommend any additional studies or regulatory actions for full-length synthetic midurethral slings. Similar conclusions of safety and efficacy have been noted from regulatory agencies in Europe, including MHRA in 2014 and SCENIHR in 2015.

Submitted June 1, 2016



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